POWER

AUGUST, 1943

POWER GENERATION, TRANSMISSION, APPLICATION AND THE ATTENDANT SERVICES IN ALL INDUSTRY

Keep flowmeters accurate for best operating efficiency. Eight-page article beginning on page 87 tells how to get the most out of your instruments by making sure they are installed properly and maintained intelligently. This meter accuracy checklist applies to every make and type of head flowmeter

Can you use colloidal fuel to conserve oil? You can if you solve certain operating and maintenance problems. Here are results of tests made with coal-in-oil by the Atlantic Refining Co. Story starts on page 72

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Page 59

Polishing internal surfaces on stator frame of Watts Bar 60,000-kw turbine-generator

LOWELL THOMAS

Famous Radio News Commentator — Author — Travel

Begins a series of Human Interest Stories written specially for

THE ALLEN-SHERMAN-HOFF CO.

In the September Issue of Powe

HYDROJET SYSTEMS OF ASH REMOVAL

•

HYDROVAC SYSTEMS OF DUST REMOVAL

•

HYDROMIX DUST VALVES

•

HYDRO-BIN DEHYDRATING ASH STORAGE TANKS

•

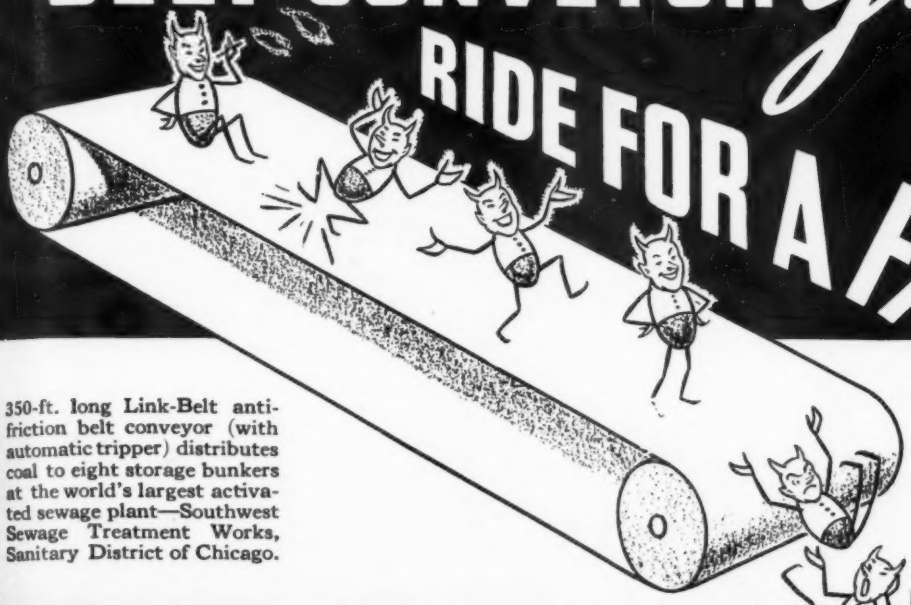
HYDROSEAL ASH PUMPS AND RECIRCULATING PUMPS

ALLEN-SHERMAN-HOFF CO., 227 S. 15th St., PHILADELPHIA • *Offices & Representatives in Principal Cities*

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), August, 1943, Vol. 87, No. 8. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and Executive offices, 330 West 42nd Street, New York, N. Y. Entered as second class matter August 25, 1936, at Post Office, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 330 West 42nd Street, New York, N. Y. Subscription rates—U. S. and U. S. Possessions, $3.00 for one year, $4.00 for two years. Canada, $3.50 for one year, $5.00 for two years. Great Britain and British Possessions 36 shillings per year. All other countries $6.00 for one year, $9.00 for two years, 35c per copy.

TECHNOLOGY DEPT:

BELT CONVEYOR *Gremlins* RIDE FOR A FALL



350-ft. long Link-Belt anti-friction belt conveyor (with automatic tripper) distributes coal to eight storage bunkers at the world's largest activated sewage plant—Southwest Sewage Treatment Works, Sanitary District of Chicago.

BRARY
AUG 6 1943
DETROIT

WHEN YOU DO THESE SIX THINGS:

1. KEEP INSTALLATION CLEAN

Make periodic inspections daily to see that there is no accumulation of material that has spilled off the belt.

2. USE IMPACT IDLERS . . .

Rubber-tread impact idlers at loading and transfer points will prolong belt life by preventing cutting and bruising.

3. "TRAIN" THE BELT . . .

For efficient operation, keep both the carrying and return runs of a conveyor belt practically centered on the supporting idlers.

4. MAINTAIN THE "TRAINING"

Maintaining the "training" of the belt on the conveyor is assured at all times if self-aligning idlers are used.

5. MAINTAIN BELT TENSION

Proper belt tension eliminates excessive belt sag between idler rolls and prevents unnecessary wear.

6. LUBRICATE PROPERLY . . .

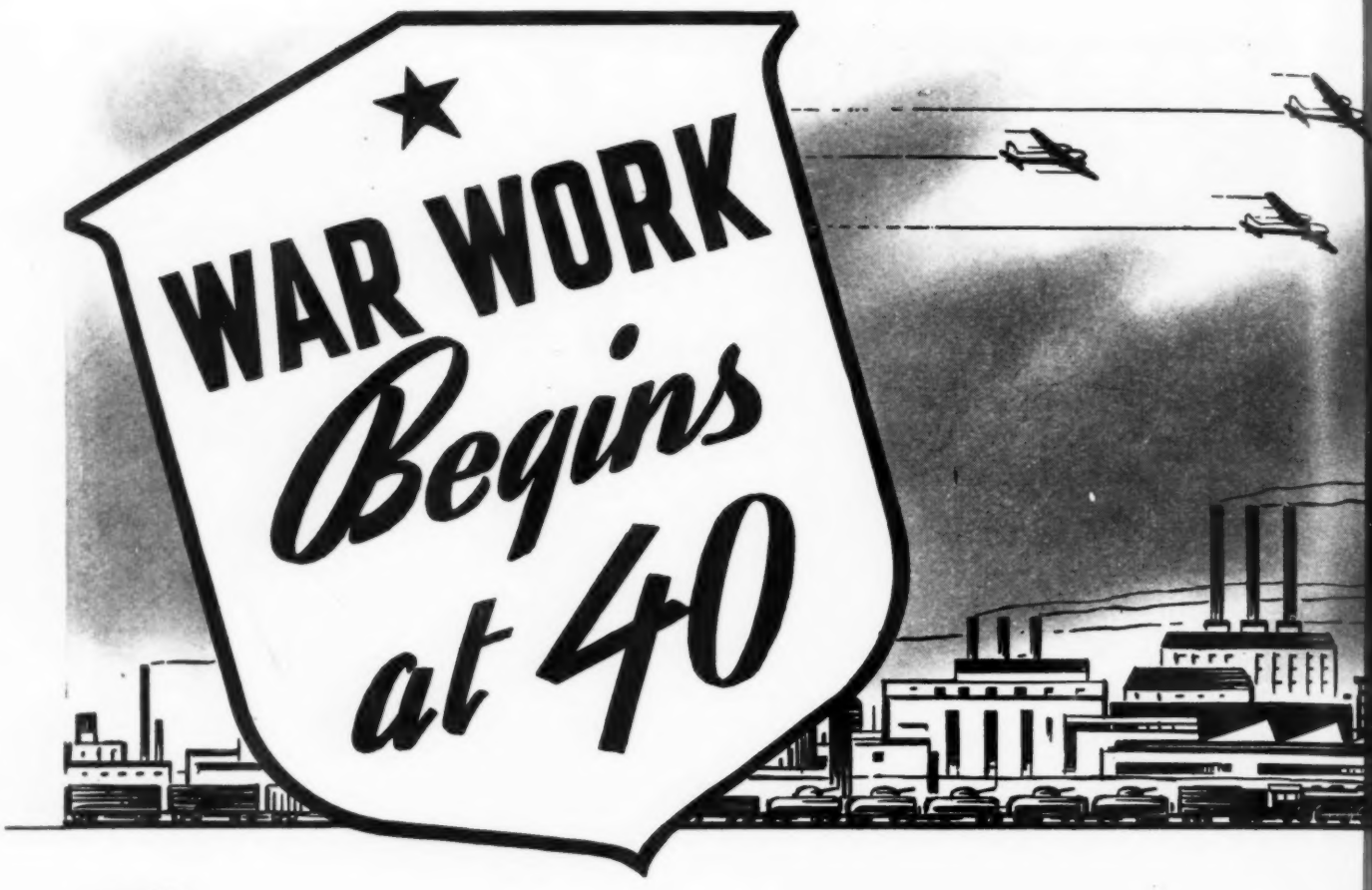
Never over-lubricate idler rolls and other moving parts for too much lubrication is as bad as too little.

GREMLIN CHASERS: Inspect equipment regularly—and make replacements with genuine Link-Belt parts when necessary. Link-Belt manufactures a complete line of idlers, pulleys, bearings, take-ups, drives, trippers, etc.

LINK-BELT
BELT CONVEYOR EQUIPMENT

LINK-BELT COMPANY
Indianapolis, Chicago, Philadelphia, Atlanta, Dallas, San Francisco, Toronto. Offices, warehouses and distributors in principal cities.

9201



For these B&W BOILERS

At the ripe age of 40, five of these central-station B&W boilers of 1902 were recently drafted for work in a Southern war plant, thereby saving critical materials that would have been required in the construction of new boilers for this service.

A lot of steam flowed from their charcoal-iron, hammer-welded tubes since they were first placed on the line, yet, when they were given a careful "physical" this year by the inspectors, they were pronounced hale and hearty, ready for induction into war service.

This fact testifies not only to the soundness of their design, but to the excellence of the materials and workmanship that entered into their construction 'way back in 1902—always a matter of pride with the manufacturers of B&W boilers. It also testifies that the boilers must have received excellent care from their operators.

And these are only five of many B&W boilers, that, after long and useful lives in other fields, are being drafted for reinstallation in war industries, where, incidentally, they will continue to receive the benefits of B&W engineering and service.

The Army-Navy "E" with two stars and Maritime Commission Award flags are floated proudly at the Barberton Works.

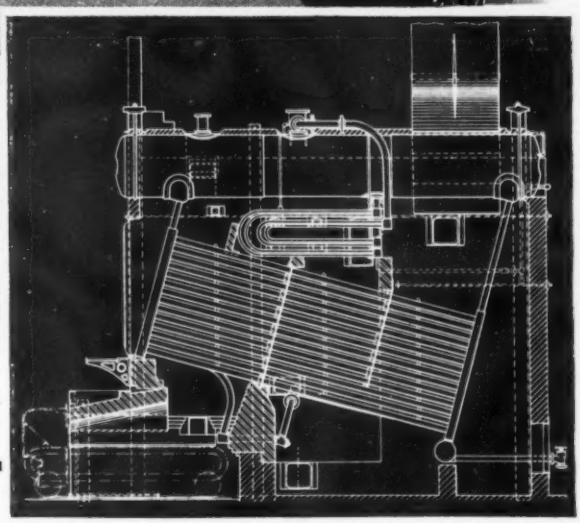
"VICTORY is a job for steam ...and steam is a job for B&W."

BABCOCK & WILCOX

THE BABCOCK & WILCOX COMPANY

85 LIBERTY STREET, NEW YORK, N. Y.

BABCOCK, WILCOX & COMPANY, 1867
THE BABCOCK & WILCOX COMPANY, 1881



G-252T

Typical installation of an Elliott marine type deaerating feedwater heater. Hundreds of these units are today serving America's sea-going power plants. They are built to operate efficiently under the special conditions of marine service.

ONE OF AMERICA'S GREAT BUILDERS OF

STEAM TURBINES
GENERATORS

STEAM JET EJECTORS
MOTORS

FEEDWATER HEATERS
AND DEAERATORS

in the power plant

The slamming roar of the big guns is dulled to heavy thuds, in the strained quiet of below decks, while the big battlewagon sways to the recoil of tons of metal starting their flight toward the enemy.

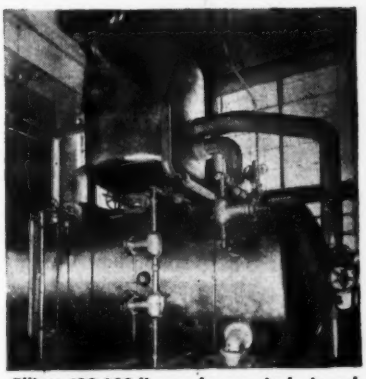
In the ship's power plant there is a tensity, a supreme watchfulness of equipment, dials, indicating instruments, and a split-second response to orders transmitted from above. Engineer officers and their staffs are winning the battle just as surely as the men at the fire-control stations. And their equipment must function positively. In the stress of battle, there must be no power failure.

So Elliott deaerating heaters, serving in Uncle Sam's fighting ships, must be—and are—as dependable in their performance as the very guns themselves. They help to win battles by heating boiler feedwater to the highest possible temperature and, by deaeration, preventing corrosion troubles in boilers, piping, and turbines.

They help to win battles on land too. On the home front in the nation's power plants, deaerating heaters have long been essential equipment. They are doing their part in the battle of production.

ELLIOTT DEAERATING FEEDWATER HEATERS

are working in steam plants of all kinds, ashore and afloat. They heat the water to the saturated temperature of the steam supplied, at the same time accomplishing the removal of corrosive gases. They are fully automatic, requiring no control or adjustment. They are the successful result of Elliott Company pioneering in the realm of deaeration beginning 24 years ago. Elliott engineers are glad to work with you today toward getting the best possible heat balance set-up for your plant. Full details and bulletin upon request.



Elliott 400,000 lb. per hour unit designed for operating pressure of 100 lb. gage. One of several such units in a large utility plant.

ELLIOTT Company

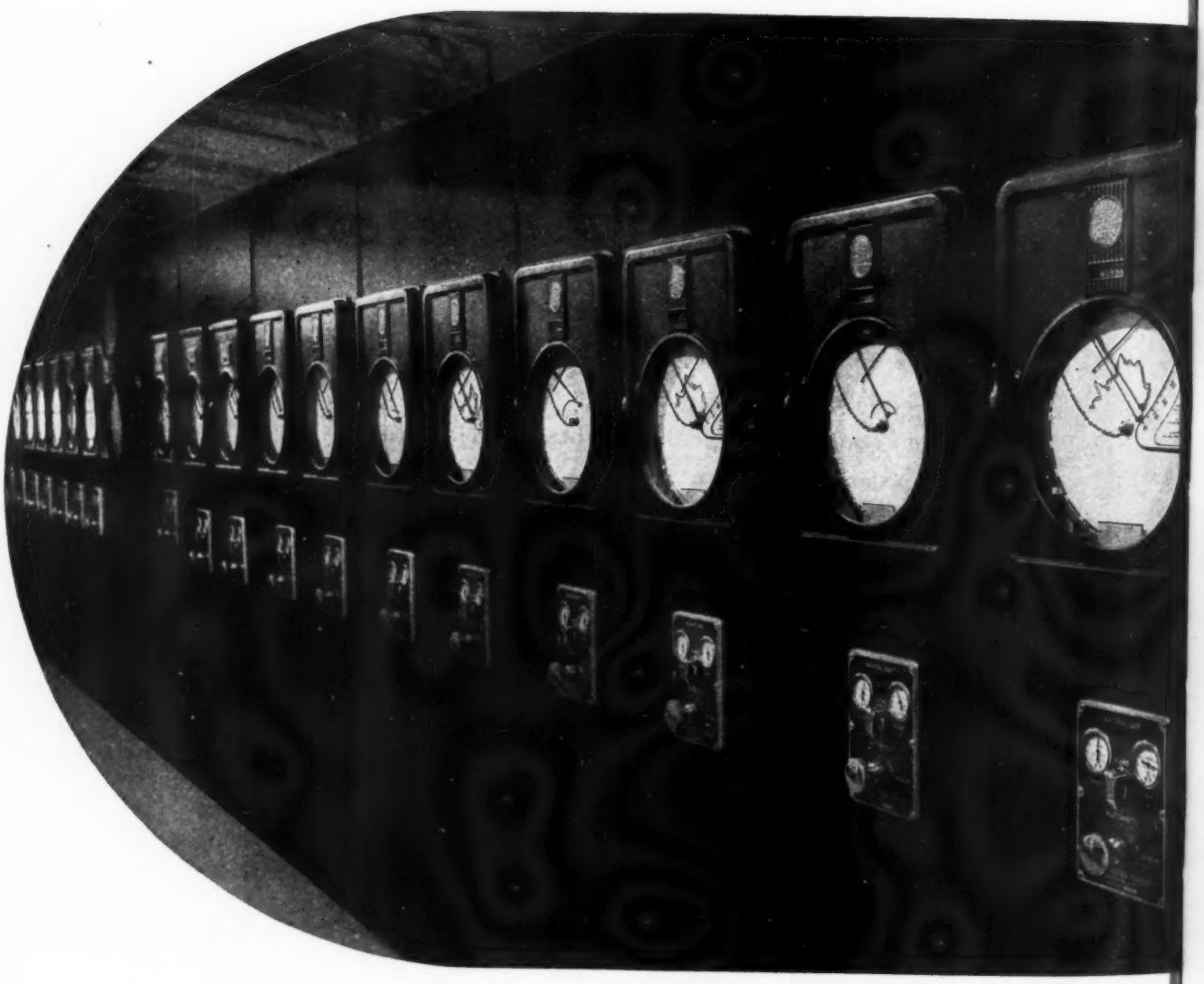
Deaerator and Heater Division
JEANNETTE, PA.
DISTRICT OFFICES IN PRINCIPAL CITIES

POWER AND PROCESS EQUIPMENT

CENTRIFUGAL BLOWERS
CONDENSERS
TUBE CLEANERS
STRAINERS
SUPERCHARGERS
FOR DIESEL ENGINES

N-974

FULL CAPACITY



Bailey Meter Control installed on gas-fired boilers in a Steel Mill Power

BAILEY METER CONTROL

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPER

WITHOUT *WASTE*

OR *OUTAGE*

Bailey Boiler Control Insures Safe Economical Operation At High Rates of Steaming

★ Full capacity is obtained from a steam generating unit only when the many factors which enter into its operation and control are carefully coordinated and accurately maintained at their optimum values.

Care must be taken in approaching these optimum values since serious waste and danger of breakdown is likely to occur unless dependable measurements of the factors are made and continuous vigilance is exercised in their control.

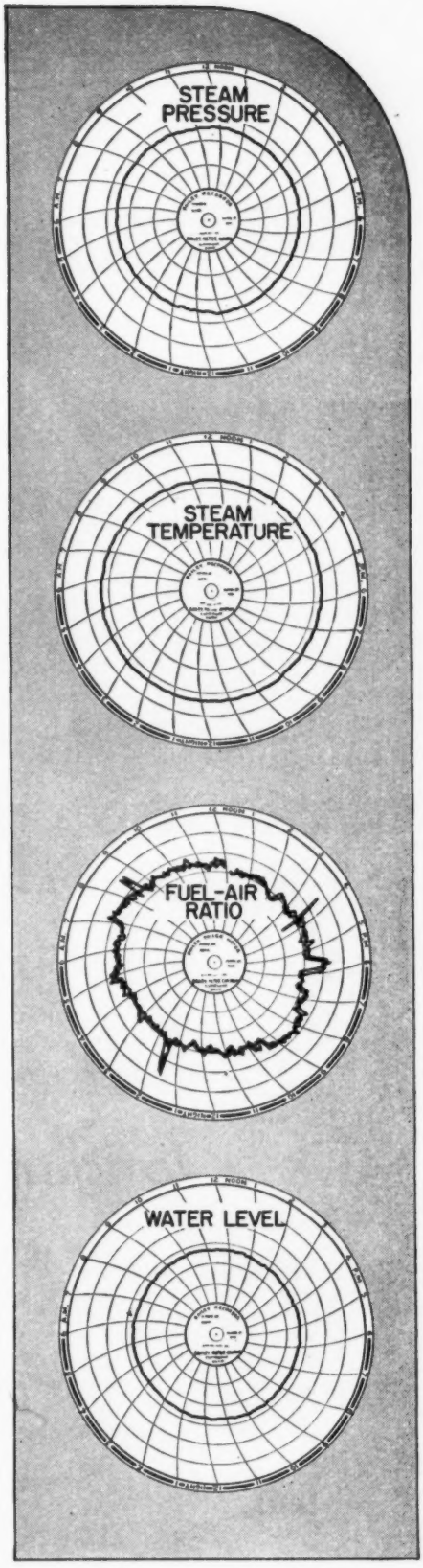
Blind efforts to increase boiler capacities by raising combustion efficiency may result in waste of fuel and in serious damage to boiler furnaces.

High capacities may be safely and economically attained with the help of Bailey Boiler Control which continuously maintains the following factors at their optimum value:

1. Steam pressure; to provide maximum turbine efficiency and to prevent waste through safety valves.
2. Steam temperature; to provide maximum turbine efficiency and to prevent damage resulting from excessive temperatures.
3. Fuel—Air Ratio; to keep to a minimum the volume of gases which must be moved through the boiler per unit of heat release, and to reduce excess air loss to a minimum without decreasing fuel economy or damaging furnace refractories.
4. Feed water flow and level; to maintain a uniform heat demand and to avoid both "high" and "low" drum level.

Bailey Meter Control serves the war effort by making it possible for power engineers to carry on with safety and economy at full capacity in spite of wartime scarcities.

A-88



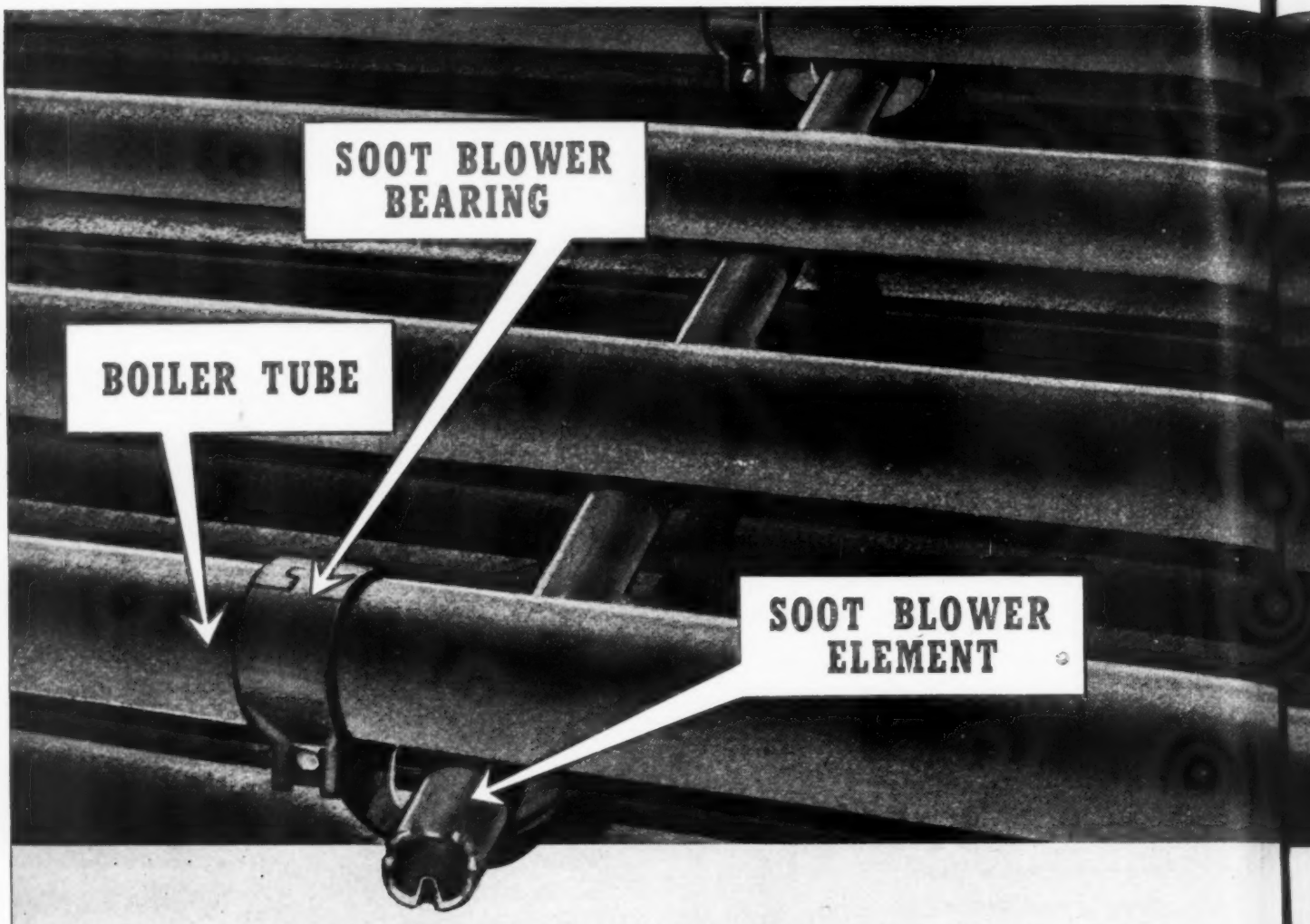
BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND, OHIO

Bailey Meter Company Limited, Montreal, Canada

he Complete Combustion Control System

NTROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL



for better boiler cleaning and
longer blower element life . . .

KEEP YOUR SOOT BLOWER BEARINGS LINED UP

DIAMOND POWER SPECIALTY CORP.
DETROIT, MICHIGAN

HEAVY demands upon the Diamond organization for war needs often make it difficult for us to supply new soot blowers, or to supply repair parts as promptly as we would like. It is important to make the soot blowers you have give service as long as possible. Careful maintenance will prolong their usefulness, keep them efficient.

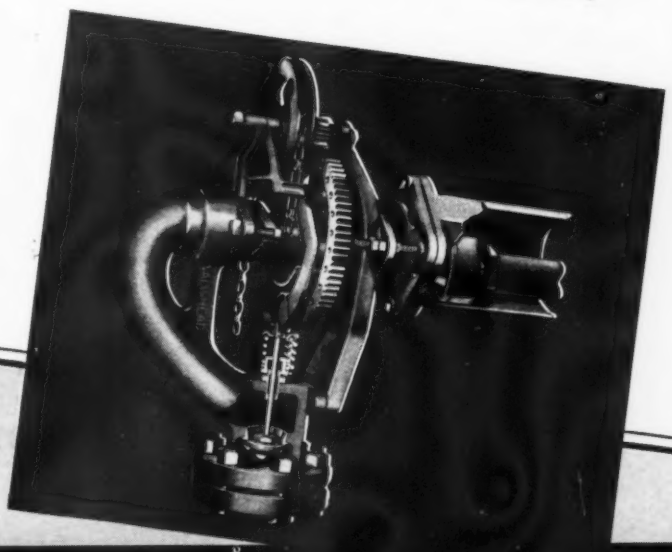
Bearings are important in the maintenance of soot blowers. Clamped bearings must be kept lined up. Serious misalignment may cause warped or broken blower elements. Every time a boiler is taken out of service, bearings should be examined and any misalignment corrected.

Bearings must be kept snug—close contact with the boiler tube cools the bearings. When tightening or renewing bearings, boiler tubes should be absolutely clean where the bearing comes in contact with the tube. After a bearing bolt nut is tightened, the bearing should be hammered lightly to be sure the bearing fits closely to the boiler tube. The nut can then usually be pulled up one or two more turns to insure the bearing being absolutely tight.

When installing new bearings, care should be taken to see that the proper number of bearings are used to support each element. In all cases, the first bearing from the head end is placed on the first tube from the wall, and in general, the bearings are spaced 9″ to 21″ apart for Calorized and Dialoy elements, and from 42″ to 48″ apart for plain pipe elements.

It is important that Calorized and Dialoy elements do not overhang the last bearing more than 11″. Where bearings are installed on every other tube, not more than one nozzle should overhang the last bearing. In the case of plain elements, not more than 24″ of the element should overhang the last bearing.

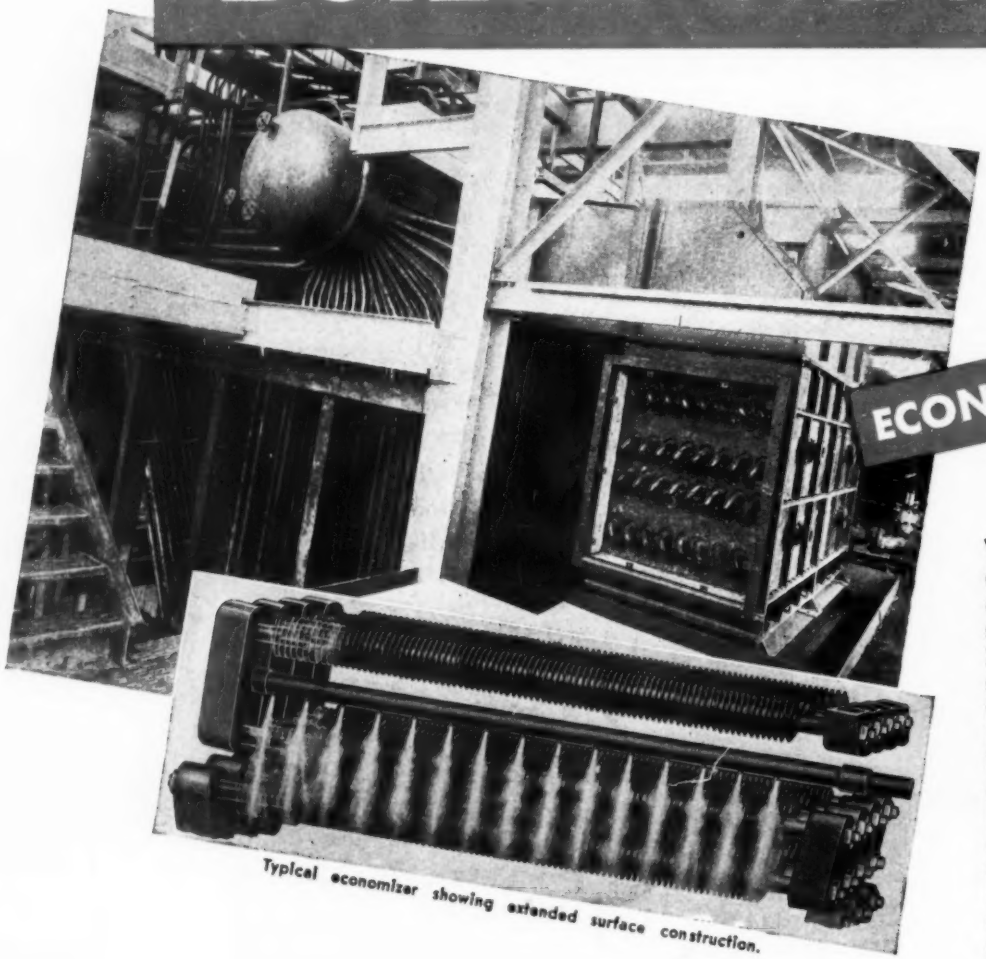
Write for this booklet on care of Diamond Soot Blowers.



THROW YOUR *Scrap* INTO THE FIGHT

DIAMOND SPECIALTY LIMITED • Windsor, Ontario

3 WAYS TO INCREASE BOILER CAPACITY



Typical economizer showing extended surface construction.

ECONOMIZERS

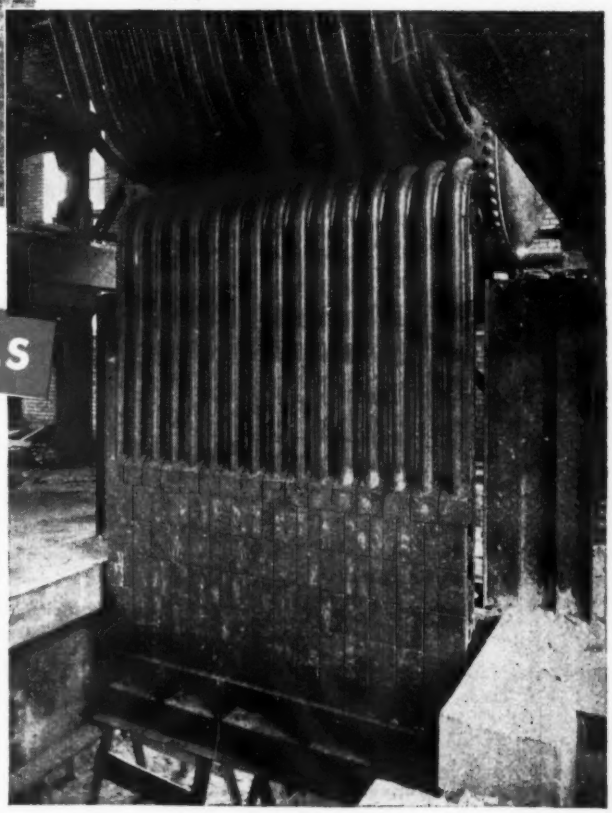
More than 4,500 Foster Wheeler extended surface economizers have been designed, built and constructed during the past 23 years for all types of steam generators . . . from H.R.T. boilers at 100 lb. pressure to 750,000 lb. per hr. steam generators operating at 1600 lb. pressure. Steam capacities have been increased an average of 10% with the addition of economizers to existing units.

FOSTER WHEELER CORPORATION, 165 BROADWAY, NEW YORK, N.Y.

FW FOSTER

SUPERHEATERS

Convection and radiant superheaters installed in existing boilers increase heat output, reduce steam consumption of prime movers, and decrease condensation losses in long steam lines. Separately fired types also available. Each Foster Wheeler superheater incorporates the engineering experience of more than 16,000 superheater installations constructed during forty years.



WATERWALLS

Furnace waterwalls present extensive radiant heat absorbing surface permitting high firing rates with increased boiler capacity; furnace temperatures are decreased and furnace life prolonged. The cooler furnace reduces maintenance problems and increases efficiency.

• Maximum "power for production" is today's goal of the boiler house operator. Increased steam demands cannot be met by new boiler units because of material shortages. Steam capacities can be increased, however, more efficient steam generation obtained, and critical materials conserved by the addition of waterwalls, superheaters and economizers to existing boilers.

WHEELER

76% OVERALL EFFICIENCY with "Jittery" Load Without Heat Recovery Equipment

THIS MONTH'S report on Taylor Stokers comes from a company whose products are fighting on every front. They obtain an overall efficiency of 75 to 76% with a rapidly fluctuating steam hammer load and without heat recovery equipment.

The Taylor Stokers responsible for this performance are power dump stokers, designed to deliver 67,000 lbs. of steam per hour at 175 lbs. gauge, 377°F. steam temperature. These units, installed in 1942, burn West Virginia and Ohio coals.

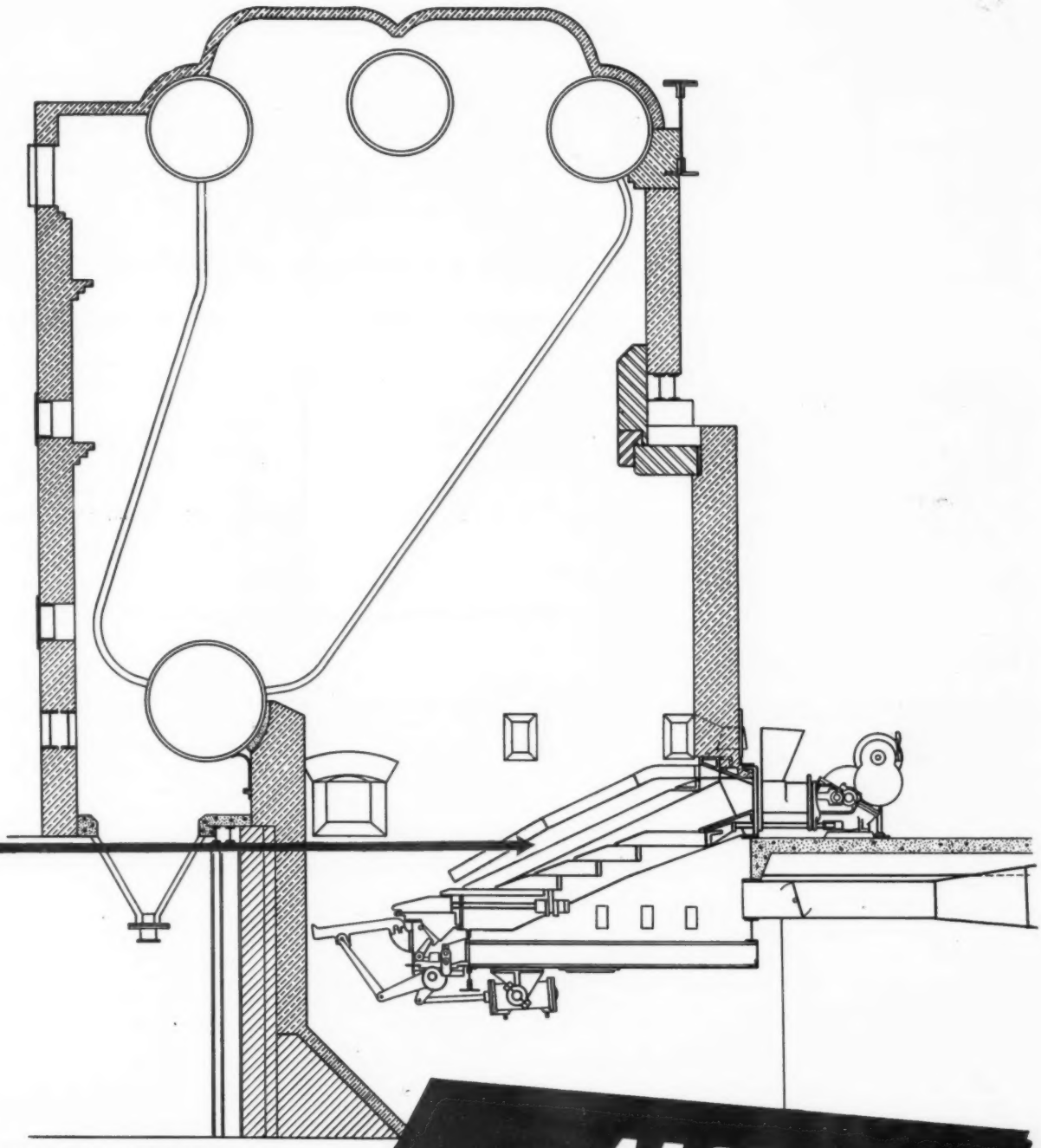
The company operates 8 other Taylor Stokers and has been a consistent purchaser since 1925. Only one conclusion can be drawn from this continued preference.

JUDGE THE SELECTION OF FUEL FIRING EQUIPMENT BY THESE TWELVE POINTS

1. RELIABILITY—the ability to operate with minimum outage and minimum standby equipment.
2. CAPACITY—the ability to provide adequate prime capacity ratings, with sufficient reserve capacity for emergencies.
3. MAINTENANCE—the ability to operate continuously with minimum repair costs.
4. FLEXIBILITY—the ability to follow the steam demand upward or downward . . . quickly and without sacrificing efficiency.
5. EFFICIENCY—the proved dollar efficiency (total cost of steam production) as shown by actual performance in similar installations.
6. OPERATION—the ability to operate continuously, the number and type of operations required, the ease of combustion adjustments, etc.
7. ADAPTABILITY—the ability to meet special and limiting conditions, present and future—structural limitations, utilization of present equipment, growth and change of power service demands.
8. FUEL FLEXIBILITY—the ability to burn efficiently and easily fuels from many sources having widely varying characteristics.
9. REFUSE DISPOSAL—the ability to economically eliminate ash or refuse and the opportunities of disposal at low cost, no cost, or profit.
10. STACK DISCHARGE—the practical elimination of "smoke nuisance" without special equipment.
11. SPACE REQUIREMENTS—the ability to conform to existing or future space limitations, to short and wide or long and narrow furnaces. Also the accessibility of component parts for maintenance and operation.
12. OBSOLESCENCE — the adaptability of the equipment toward possible future modernization with minimum of complication and outage.

AMERICAN ENGINEERING

PHILADELPHIA • PENNSYLVANIA



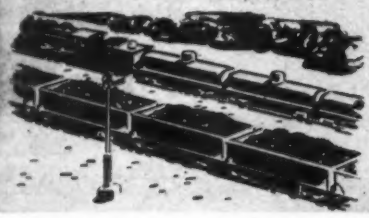
A-E-CO TAYLOR STOKERS
LO-HED HOISTS
HELE-SHAW FLUID POWER
MARINE DECK AUXILIARIES

A-E-CO
TAYLOR STOKER

COMPANY

Æ CO 75th ANNIVERSARY

First Aid Chart

	WAR CONDITIONS	POWER PROBLEMS
Manpower	Skilled operators being called for military service. Fewer experienced operators available for replacement. Inexperienced men to be trained.	Power plants must be operated at maximum capacity and efficiency with fewer skilled operators who, at the same time, must aid in the training of new and inexperienced men.
Fuel 	Transportation difficulties threaten curtailment of fuel shipments causing temporary fuel shortages.	Emergency fuel must be obtained and stored. Available fuel must be burned at maximum efficiency to stretch present supply and to minimize haulage. Must be prepared to burn a substitute fuel if necessary.
Steam	Big increase in steam demand. Lack of generating capacity. New steam generating equipment hard to get even with good priorities.	Every possible pound of steam must be squeezed from present generating units to meet new load demand. Process steam waste must be checked and held to a minimum.
Maintenance	All equipment operating at overload. No stand-by equipment. Replacement parts difficult to obtain. Inexperienced operators.	Maintenance and repairs must be taken care of promptly, in spite of a shortage of experienced maintenance men or difficulties in getting materials, in order to avoid major shut-downs.

REPUBLIC
INSTRUMENTS
AND CONTROLS

FOR SOLVING WARTIME POWER PLANT PROBLEMS

THROUGH the use of instruments and controls you may be able to increase your steam supply just enough to get it over the peak. Republic engineers will be glad to consult with you. Write to us today.

INSTRUMENTS	BOILER CONTROLS	PROCESS CONTROLS
IMPROVE SUPERVISION Instruments provide operators with continuous indications of operating conditions. Permit centralized supervision of all operating factors. Provide continuous record of performance.	**CONSERVE MANPOWER** Automatic boiler controls, by performing the routine repetitive adjustments, free the operators for more important supervisory duties.	**STRETCH SKILL** Automatically perform routine repetitive adjustments to maintain desired conditions thereby enabling the operator to surpervise the operation of a larger number of units.
CHECK LOSSES CO_2 meters, draft gages and flue gas temperature recorders provide a continuous check on combustion efficiency and preventable heat losses. Steam meters serve as a guide for the proper load distribution among boilers.	**SAVE FUEL** Automatically maintain highest combustion efficiency by controlling fuel and air input, in a fixed predetermined ratio, over the normal load range. Provide for changes in fuel characteristics and other operating factors.	**REDUCE WASTE** For every pound of steam wasted and for each extra gallon of watar pumped, etc., a corresponding amount of fuel had to be consumed in the boiler room. Automatic controls reduce power waste and thereby save fuel.
CHECK STEAM WASTE Meters installed on main distribution lines will immediately center attention on the department or unit using excessive amounts of steam. They provide the information needed to coordinate steam consumption with steam production.	**TEST EFFICIENCY** Produce maximum steam output at test efficiency by maintaining constant steam pressure, maximum combustion efficiency, constant and correct furnace draft and desired load division among boilers.	**MORE STEAM** By reducing the power consumption of pumps, compressors, dryers or other steam consuming units, through the use of automatic controls, you increase the effective capacity of your power plant.
LOCATE TROUBLE SPOTS Instruments, by providing a check on the performance of various units, are invaluable in spotting potential trouble spots before they develop to a point where they require extensive repairs and interfere with production.	**REDUCE OUTAGES** Correct boiler operation reduces outages. Boiler controls, by coordinating all operating factors, prevent the chain-of-events type of trouble that may lead to serious shut-downs.	**UNIFORM PERFORMANCE** Maintain correct process conditions under continuous operation at peak capacity. When both operators and equipment are working at capacity close control is vital to prevent serious maintenance outages.

Republic Flow Meters Co.

2222 Diversey Parkway • Chicago, Illinois

Solid rounds of alloy steel for 75mm. gun-barrels are pierced on a pipe mill by J & L skilled workmen.

COPYRIGHT 1943 — JONES & LAUGHLIN STEEL CORPORATION

FROM AN ORIGINAL DRAWING BY ORISON MACPHERSON

NEW PRODUCTION TEAM DELIVERS THE GUNS FOR VICTORY

The new 75mm. gun, descendant of the famous French 75 of World War I, is winning victorious acclaim in this war for and by our armed forces. This powerful weapon is one of the keystones in the teamwork our armed forces are employing on the fighting front to defeat the enemy.

Likewise on the industrial front it is teamwork that is producing these 75mm. gun-barrels at a fighting pace. The steel comes from a leading alloy steel manufacturer in the form of solid rounds eight feet long. At the Jones & Laughlin seamless tube mills, where oil country pipe is normally produced, these alloy steel rounds are heated and pierced their full length. Next steps are upsetting (forging) the breech end and heat-treating by a famous bearing manufacturer. Final stage is the machining and rifling by a New England machine tool company.

Four steps — four companies — each doing for Victory the thing best suited to its experience, skill and equipment. This is another example of war cooperation taking the place of competition in industry . . . of teamwork on the production fronts that matches the teamwork on the fighting fronts among our armed forces and those of our allies.

PITTSBURGH WORKS

ARMY E NAVY

ALIQUIPPA WORKS

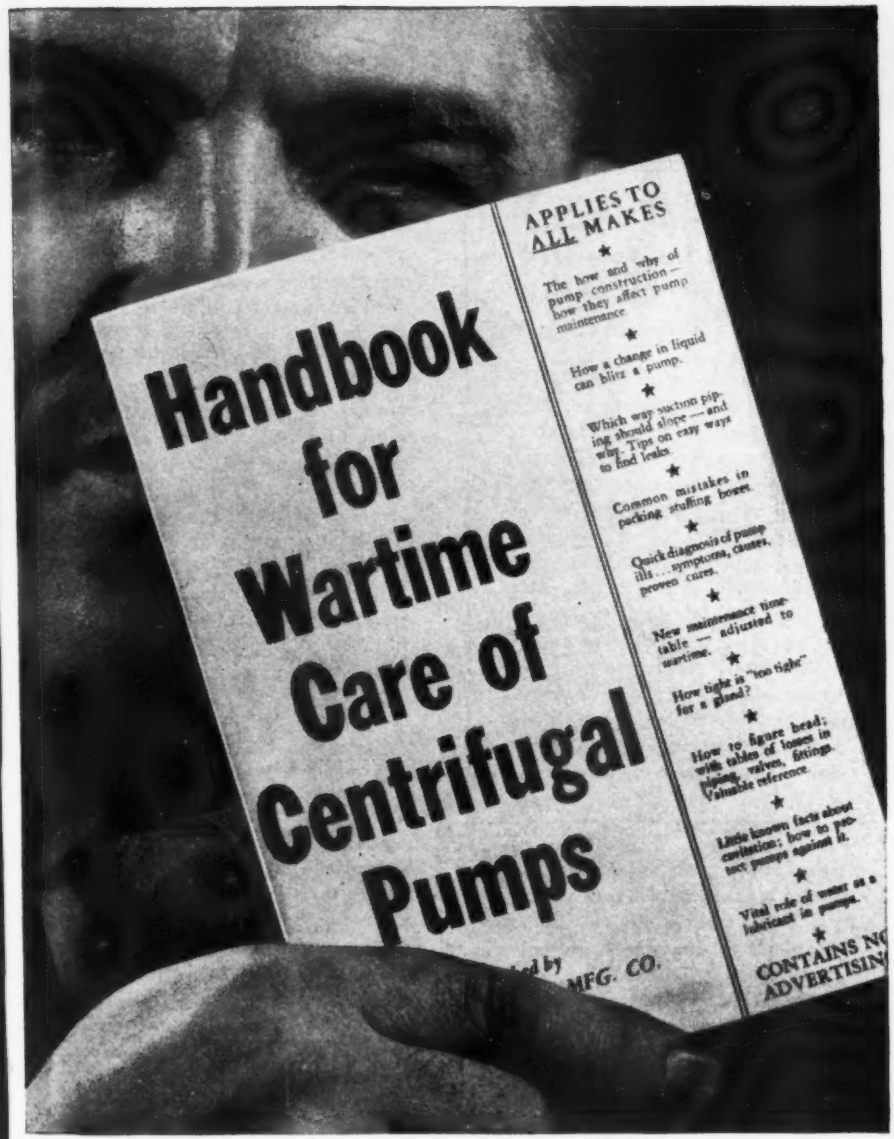
JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH, PENNSYLVANIA

CONTROLLED QUALITY STEEL FOR WAR

J&L STEEL

"It's Tops on Pumps!"


Handbook for Wartime Care of Centrifugal Pumps
APPLIES TO ALL MAKES
The how and why of pump construction — how they affect pump maintenance
How a change in liquid can blitz a pump.
Which way suction piping should slope — and why. Tips on easy ways to find leaks.
Common mistakes in packing stuffing boxes.
Quick diagnosis of pump ills . . . symptoms, causes, proven cures.
New maintenance timetable — adjusted to wartime.
How tight is "too tight" for a gland?
How to figure head; with tables of losses in piping, valves, fittings. Valuable reference.
Little known facts about cavitation; how to protect pumps against it.
Vital role of water as a lubricant in pumps.
CONTAINS NO ADVERTISING

When you do need new pumps—take a good look at the extra efficiency, ruggedness and long life built into Allis-Chalmers centrifugal pumps . . . the famous "Electrifugal" — and all types for every purpose. Meanwhile, let "Handbook for Wartime Care of Centrifugal Pumps" help you make present pumps *last*! →

ALLIS-CHALMERS
MILWAUKEE

WE WORK FOR VICTORY — WE PLAN FOR PEACE

YOUR TECHNICAL LIBRARY ISN'T COMPLETE UNTIL IT HAS A COPY OF ALLIS-CHALMERS' GREAT NEW PUMP MAINTENANCE GUIDE. IT'S FREE —SEND TODAY!

MOST BOOKS on pump care published before the war are *seriously out of date* today! Why? Pumps that used to work 1800 hours a year now work as many as *8700* hours! For *timely* aid get "Handbook for Wartime Care of Centrifugal Pumps!"

A pump is built, step by step, on paper. Tips and tables show how to diagnose, how to remedy trouble — apply to all makes of pumps. *It's Free*! Tear out and mail order form below today!

ALLIS-CHALMERS MFG. CO.
Milwaukee, Wisconsin

Gentlemen:
Yes, I would like to receive *free of charge* a copy of your "Handbook for Wartime Care of Centrifugal Pumps".

(Name)

(Title)

(Company)

(Street Address)

A-1585-2 (City and State)

Scovill Tube News

Vol. 1 SCOVILL MANUFACTURING COMPANY, Waterbury, Conn. No. 6

Choosing the Right Alloy for Long-Lived Condenser and Heat Exchanger Tubes

Selection of Material

The selection of the alloy for any particular service, will depend upon the conditions under which it must operate. The many factors which must be considered in this connection have already been discussed. It is evident that each application of tubes in a condenser or heat exchanger is an individual problem which must be studied in detail before any specific recommendation can be made regarding the most economical and satisfactory tube material for use in the particular case. An investigation of this kind would cover not only a survey of all the known service conditions but would also take into consideration the alloy previously used and the type or form of corrosion previously experienced in the unit in question or in similar units operating under similar conditions. It is obvious that the subject can only be treated in a very general way without a consideration of all the essential facts which might apply to an individual case. The following information, therefore, is designed principally to give some indication of the conditions under which available condenser tube materials have given satisfactory service. In most cases it will be noted that two or more alloys may be used under a certain set of service conditions; in certain services, it is true that a rather wide choice of tube materials may be made without any appreciable difference in operating costs or service life. In other cases, where corrosion of some form is particularly severe, selection may be limited to one or possibly two of the more refractory materials.

Muntz Metal:

Nominal Composition, Copper 60%; Zinc 40%. Muntz metal tubes have been used extensively in both fresh and salt water service in steam condensers operating at relatively low temperatures. Use at the present time is confined chiefly to steam condensers at inland stations with fresh circulating water from rivers, lakes or wells. Muntz metal also has good resistance to hydrogen sulphide and other active sulphur compounds but is seldom used in applications where corrosion by such compounds is severe primarily because other factors, such as high temperature, high velocities, badly contaminated waters, etc., are usually active at the same time. Failure of Muntz metal tubes occurs usually as a result of gradual dezincification of the layer type. Muntz metal tubes in fresh water steam power plant installations have had a service life of twenty years or more.

Admiralty Metal:

Nominal Composition, Copper 70%; Zinc 29%; Tin 1%. This alloy has excellent corrosion-resistant properties and is used widely in tube form in such diverse services as: steam condensers using fresh, salt, brackish or acid mine water for circulating purposes; heat exchangers, coolers, etc., in oil refineries where corrosion from sulphur compounds, acids and contaminated waters may be very severe; feed water heaters, heat exchanger equipment in industrial processes, etc. Admiralty metal tubes are often used in apparatus operating at temperatures of 400°F. or higher although severe dezincification of the alloy may be experienced under certain service conditions at elevated temperatures. Admiralty metal has a tensile strength of approximately 50,000 pounds per square inch in the finished annealed condition, together with excellent ductility. The strength of the alloy is retained up to a temperature of approximately 300°C. (570°F.).

Phosphorized Admiralty Metal:

Nominal Composition, Copper 70%; Tin 1%; Phosphorous 0.03%; Zinc remainder. The addition of a very small percentage of phosphorus to admiralty metal increases the dezincification-resistance of the alloy to a marked degree without impairment of the excellent chemical and physical properties of the alloy. Phosphorized admiralty metal was developed, therefore, particularly for installations where severe dezincification of admiralty metal has been experienced or is anticipated. Combining as it does resistance to dezincification and resistance to corrosion by sulphur compounds, acids, contaminated fresh and salt waters, etc., phosphorized admiralty metal has found wide usage.

Red Brass:

Nominal Composition, Copper 85%; Zinc 15%. Red brass is sufficiently high in copper content so that it does not dezincify under normal service conditions; it is also not as susceptible to season cracking or stress-corrosion cracking as brasses of lower copper content

Scovill's Analytical "Service In Manuals" Helps Many Firms Save Scarce Tube Metals

Both before and after installation of condenser or heat exchanger tubes, success depends on expert knowledge of the exact interrelation of tube alloys with the service conditions. This article is part of Scovill's continuing "Tube News" series; all preceding issues, dealing with tube manufacture, causes of corrosion, etc., are available on request, together with Scovill's up-to-date "Condenser Tube Booklet" covering the broad range of problems bearing on tube life. Address, Scovill Manufacturing Company, 17 Mill Street, Waterbury, Conn.

and combines favorable physical and chemical properties to make it a very serviceable alloy for many heat exchanger installations. Red brass tubes have been used chiefly for service in contact with fresh waters although tubes of this alloy have also served very satisfactorily in uncontaminated salt water. This alloy is not generally recommended for use where corrosion by Hydrogen Sulphide or other active sulphur compounds is liable to be severe.

Deoxidized Copper:

Tubes of deoxidized copper (copper content 99.90%) are limited to applications where the high purity of the material is essential or where it is necessary to utilize the high thermal and electrical conductivity of pure copper. It has excellent resistance to practically all types of fresh water and to many chemicals. It is not usually serviceable in contact with salt water or active sulphur compounds. In the hard-drawn temper copper has a strength of approximately 60,000 pounds per square inch but it does not retain this strength at temperatures of 200°C. or higher.

Arsenical Coppers:

Nominal Composition, Arsenic 0.35%; Copper balance. The alloying of a small percentage (0.15–0.50) of arsenic with copper reduces the electrical and thermal conductivity of the copper 25% to 50%. Compared with deoxidized copper, arsenical copper has (1) a higher softening or annealing temperature (300°C. against 200°C.), (2) increased strength, hardness and stiffness of cold drawn material with no impairment of ductility, a higher fatigue limit, etc. Arsenical copper has been reported to be slightly more resistant to atmospheric corrosion than copper and equally as corrosion-resistant as copper in salt or fresh waters. Arsenical copper tubes find their principal usage in condensers and heat exchangers using fresh circulating water; they are not usually recommended for service in contact with hydrogen sulphide or other active sulphur compounds, with media carrying an appreciable percentage of organic acids, particularly in the presence of air (oxygen) or with acid solutions of an oxidizing character, such as acid mine waters. Their chief advantages over deoxidized Copper for heat exchanger service are (1) greater strength, (2) better resistance to erosion and abrasion, and (3) higher softening temperature.

Aluminum Brass:

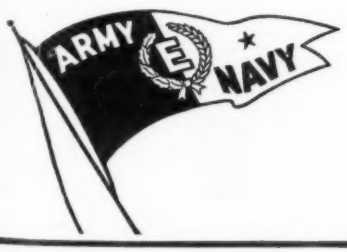
Nominal Composition, Copper 76%; Aluminum 2%; Zinc 22%. The addition of approximately 2.00% of Aluminum to Brass of the above copper content, improves the resistance of the resulting alloy very materially, particularly to corrosion by salt and brackish waters and to combined erosion and corrosion in salt water service. The excellent corrosion resistance of this depends upon the nature of the film which develops over the surface of the tube. In service, this surface film is of the desired properties (thin, adherent, continuous, compact) to give excellent protection to the metal even under very severe water conditions; in addition the film is self-healing in case of a local breakdown, such as might occur through abrasion or erosion of the metal surface, making tubes of this alloy very serviceable in installations where tubes of other alloys might suffer rapid localized corrosion. Aluminum Brass tubes have been used quite extensively during the past ten years in marine condensers and in steam condensers of tidewater stations where relatively high velocities of the circulating water, together with turbulence and air bubble impingement, have a particularly severe local wearing action on Admiralty metal and other brass tubes.

70-30 Copper-Nickel:

Nominal Composition, Copper 70%; Nickel 30%. Tubes of this alloy are used in heat exchanger equipment under conditions where severe wear and corrosion have been experienced, particularly at elevated temperatures and at high velocity of the circulating media. Copper-Nickel tubes have given excellent service, for example, in ship condensers of the U. S. and British Navies, in steam condensers of tidewater stations where brackish or salt circulating waters are very corrosive, in various oil refining units operating at relatively high temperatures and in contact with corrosive materials, etc. 70–30 Copper-Nickel combines excellent corrosion-resistant properties with very favorable physical characteristics, such as high strength and extreme ductility. The strength of the alloy is retained even at relatively high temperatures. The thermal conductivity of this alloy is approximately one third that of Admiralty metal; actually, however, the heat transfer coefficient of a new unit is reduced only slightly when Copper-Nickel tubes are used in place of Admiralty metal. Some designers of heat transfer equipment allow 5% more tube surface area when Copper-Nickel replaces Admiralty or other brass tubes. Copper-Nickel tubes are not subject to season cracking or stress corrosion cracking so they may be used with safety either in the finished annealed or hard drawn condition. The preference at this time is for finished annealed tubes.

80-20 Copper-Nickel:

Nominal Composition, Copper 80%; Nickel 20%. The Copper-Nickel alloy containing 20% nickel has similar physical and chemical properties to the 70-30 Copper-Nickel and is, therefore, used in the same type of service, i.e., in marine and tidewater steam condensers, in oil refining installation, etc. The corrosion-resistant properties of the alloy are not equal to those of the higher nickel alloy so that the 70-30 alloy is still generally used under extremely severe conditions. In many cases, however, conditions may not be severe enough to justify the use of 70-30 Copper-Nickel and in such cases, 80-20 Copper-Nickel may give economical and satisfactory service.



THIS IS NUMBER SIX in a Series of Scovill Advertisements to help you get longer life from condenser and heat exchanger tubes.

Scovill
MANUFACTURING COMPANY
WATERBURY, CONN.

SCOVILL CONDENSER TUBES

ONE PRODUCT... THREE SERVICES

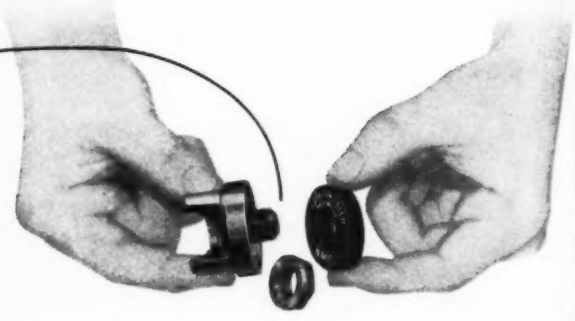
Service in Manuals... Service in Metals... Service in Men

Simplicity of Design Means Easier Maintenance

Plug

for

Disc can be renewed in a jiffy. Simply unscrew locknut from disc holder, remove old disc and insert new one—reassemble and the valve is ready for use. Or better still, keep on hand some spare disc holders complete with discs — slip a disc holder and a new disc on the stem and remove the old disc from the holder when you have time.



"N-M-D" (NON-METALLIC DISC) GLOBE, ANGLE AND CHECK VALVES

Value

the Maintenance Man...

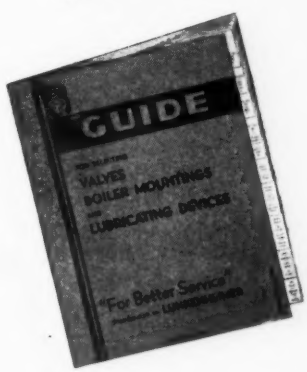
The scarcity of new valves these days places a premium on the lasting qualities and repairability of those you now have in service.

Valves with a minimum of parts . . . that are easily accessible for cleaning and repairs . . . that are made to such true tolerances that parts are interchangeable *in fact* . . . such valves give a plus value in time-saving and low-cost servicing.

Maintenance men who work with Lunkenheimer valves are receiving continual proof that simplicity of design means easier maintenance . . . they are getting better service longer, and doing a better job faster.

The complete facilities of Lunkenheimer distributors are at your service. They'll help you get what you need and there's one near you to serve you.

Ask for Lunkenheimer Catalog 78 and the Guide for selecting Valves, Boiler Mountings and Lubricating Devices.



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Progress and Power in the

Food for the guns, warheads for torpedoes, explosives for mines, bombs, grenades and mortar shells—on them our armed forces depend for Victory. They are our assurance of Liberty in a free world.

We, at American Blower, are proud of our privilege to contribute muscles, machines and brains to the manufacture of vital equipment for America's giant Ammunition Industry. Every facility we own is today in service for Victory.

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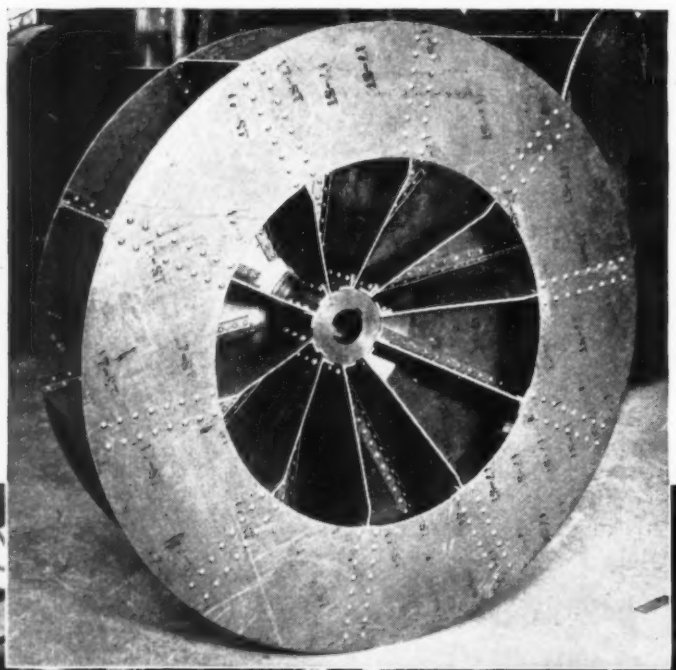
We have but one pledge—one purpose: To produce more and more so that the Axis powers of evil may perish from the Earth.



Radial Blade H.E. Blowers with spark-proof wheels for circulating explosive fumes in the manufacture of smokeless powder. Left, above, is a spark-proof wheel showing interior construction. Where men's lives may depend upon it, American Blower apparatus is a safe choice.

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CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONT.

Division of American Radiator and Standard Sanitary Corporation

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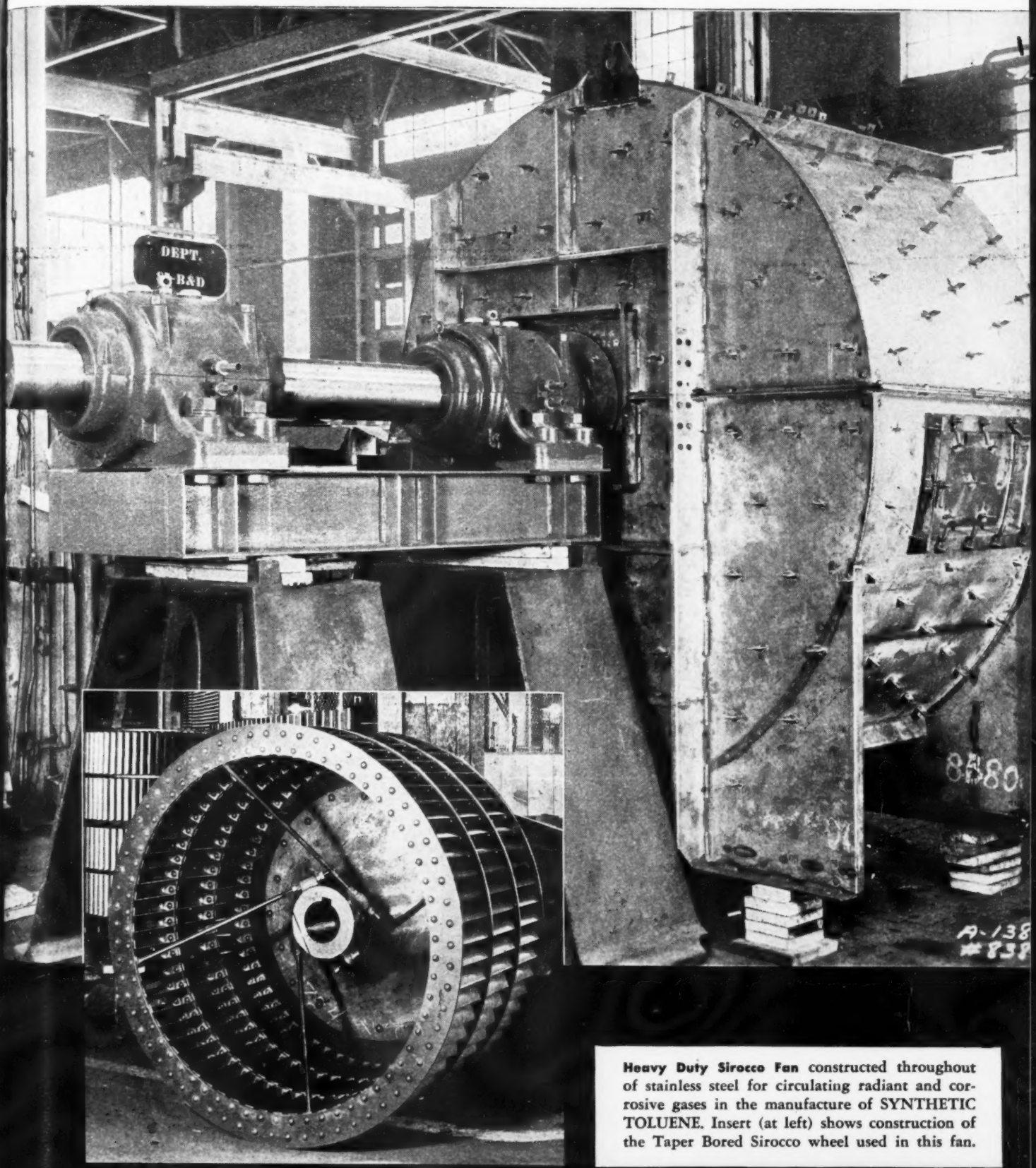
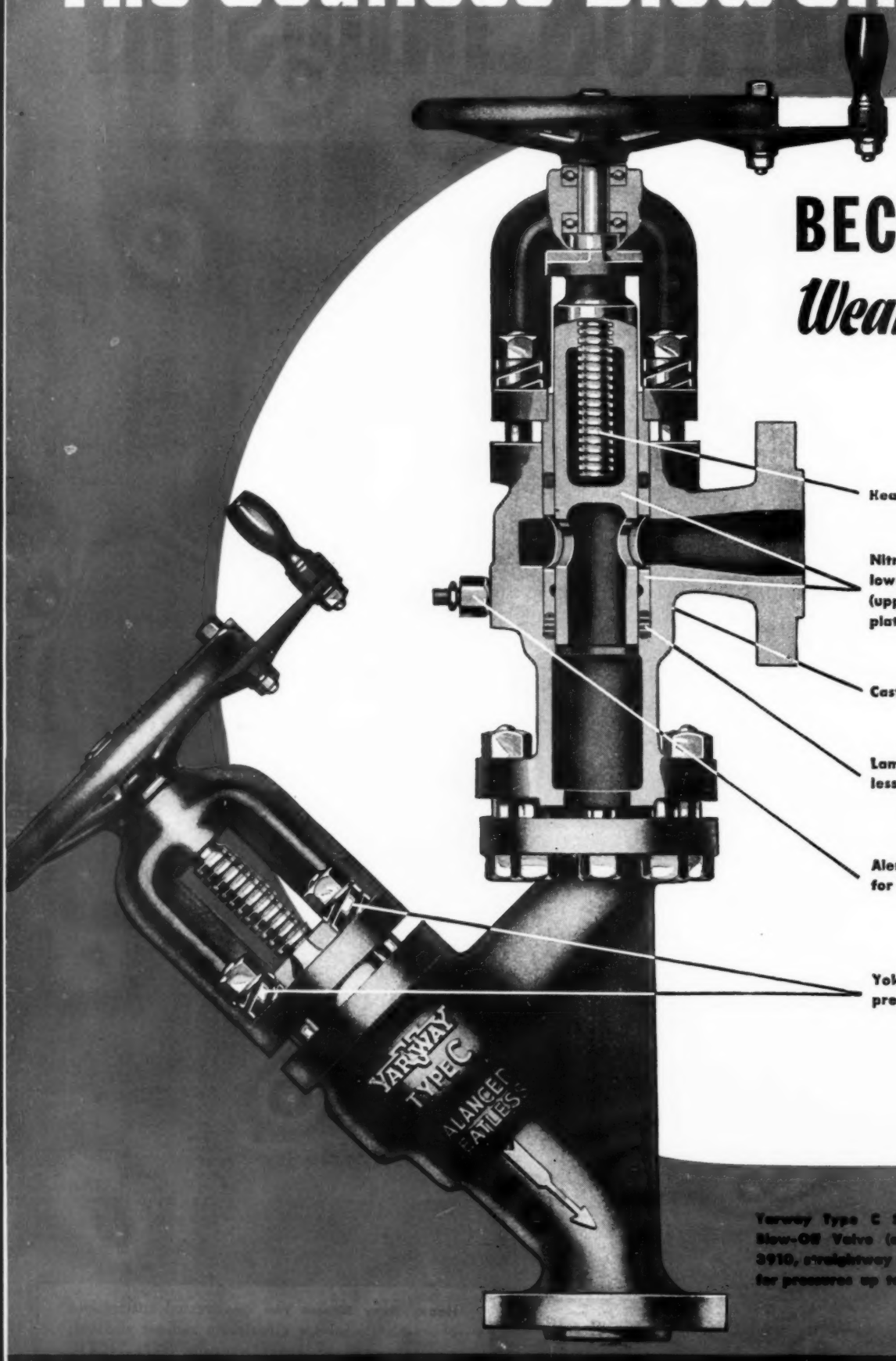


Heavy Duty Sirocco Fan constructed throughout of stainless steel for circulating radiant and corrosive gases in the manufacture of SYNTHETIC TOLUENE. Insert (at left) shows construction of the Taper Bored Sirocco wheel used in this fan.

The Seatless Blow-Off Valve

BECAUSE ★ ★ ★

Wear and Clog wit



Heat-treated steel stem.

Nitralloy Plunger and lower Follower Gland. Brinell hardness 1100 (upper Follower Gland, chromium plated steel).

Cast Steel Body and Yoke.

Laminated packing ring with stainless steel reinforcing inserts.

Alemite lubrication of Plunger (also for ball thrust bearings in yoke).

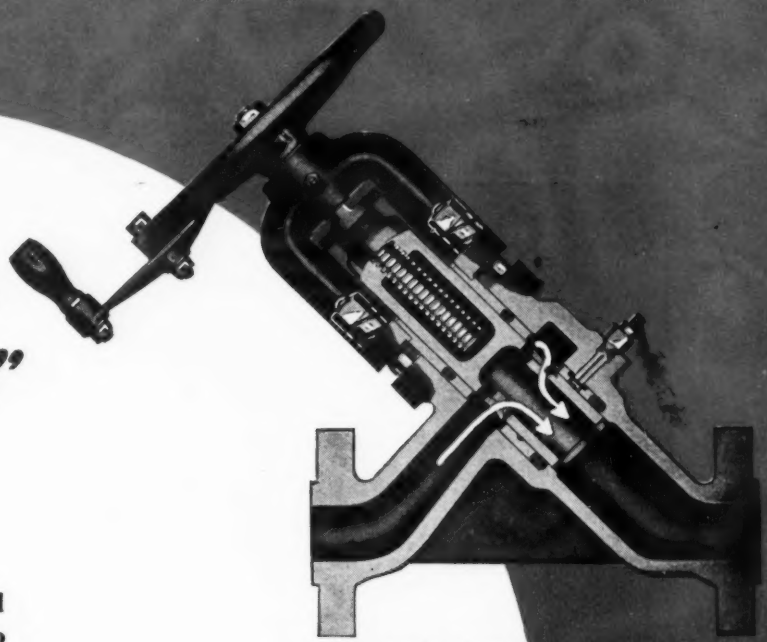
Yoke Springs maintain required pressure on packing at all times.

Yarway Type C Seatless Tandem Blow-Off Valve (angle valve - Fig. 3910, straightway valve Fig. 3912) for pressures up to 600 lbs.

YARWAY

"Standard" in Over 12,000 Plants

"No Seat to *Score, Mud, Scale and Dirt*"

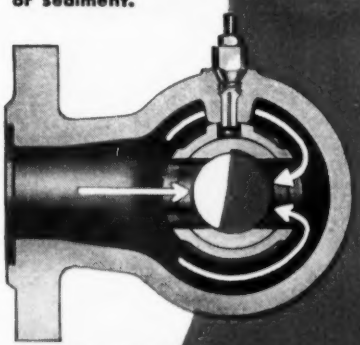


Note ample space for free flow with no projections or pockets to accumulate scale or sediment.

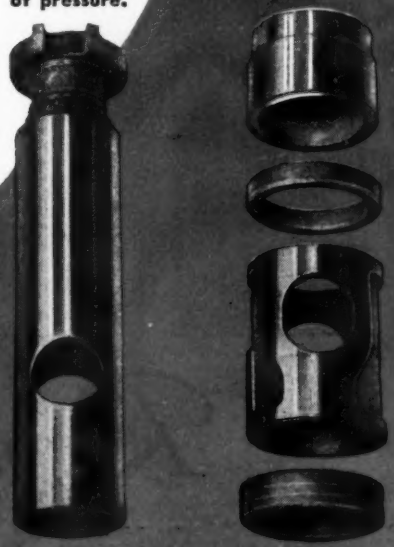
More than a quarter century ago, Yarway introduced their Seatless Blow-Off Valve and said—"No seat to score, wear and clog with mud, scale and dirt." Power plant operators, harassed by continuous trouble and expense with conventional valves—welcomed the Yarway as the answer to their troubles . . . purchased them, watched them, standardized upon them. And the Yarway Seatless design, in a relatively short time, became the most widely preferred blow-off valve.

Today, after a quarter century of service, it still holds that distinction. Sound fundamental design...coupled with continuous mechanical and metallurgical research anticipating ever-new service requirements . . . makes the highly improved Yarway Seatless Valve of today just as good insurance against blow-down trouble and expense in today's plants as it was in the plants of twenty-five years ago.

There is a Yarway Valve for every pressure and purpose. Write for Catalog B-422 for pressures up to 400 lbs. Catalog B-431 for higher pressures.



Pressure surrounds plunger making a fully balanced valve easy to operate regardless of pressure.

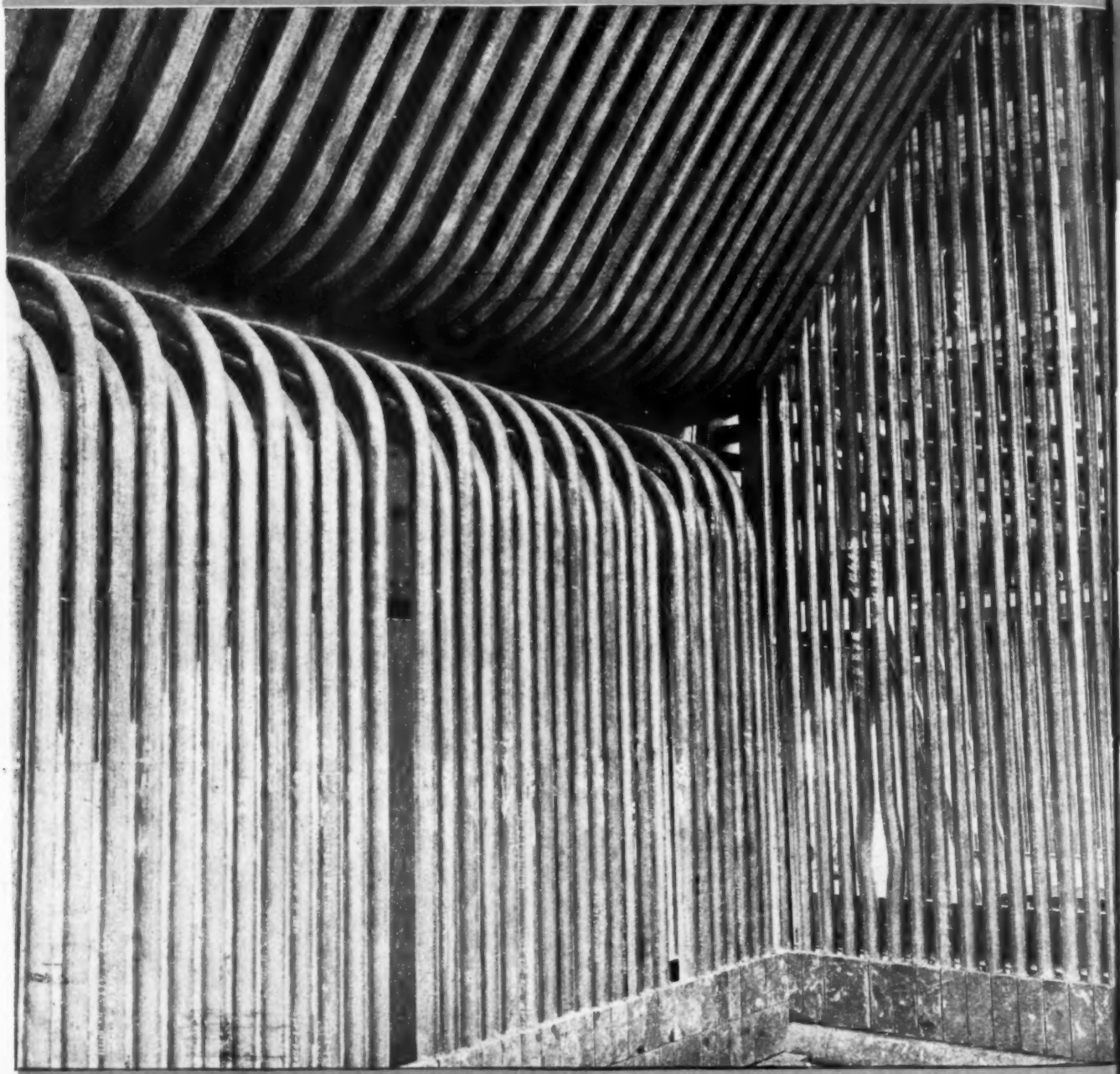


Nitralloy plunger and lower follower gland, and laminated packing with stainless steel inserts, add years to valve life.

YARNALL-WARING COMPANY
100 Mermaid Ave. Philadelphia 18, Pa.

BLOW-OFF VALVES

TIME has told

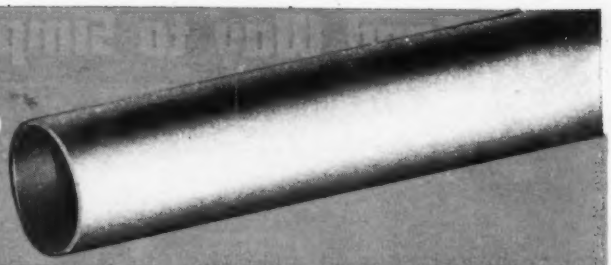


Republic

ELECTRUNITE

Reg. U. S. Pat. Off.

the value of this BOILER TUBE



When Republic ELECTRUNITE Boiler Tubes were first introduced, the skeptics said: "Time will tell!"

They were right, because time—more than ten years of it—during which ELECTRUNITE has seen service in steam generating and heat transfer equipment of every type in practically every branch of industry—has told boiler manufacturers and users the value of this boiler tube.

Time has proved that ELECTRUNITE is safe, sound and economical.

Time has demonstrated that ELECTRUNITE has the inherent ability to stand up in critical service for long periods of operation.

Time has shown how ELECTRUNITE'S *consistent uniformity* of wall thickness, diameter, concentricity, strength, weight, ductility and scale-free surface cuts installation and maintenance costs.

Today, Republic ELECTRUNITE Tubes are adding further evidence of dependability to this ten-year record through their performance under the demands of war production.

ELECTRUNITE meets the requirements of:

American Society of Mechanical Engineers — A. S. M. E. Boiler Construction Code S-32.

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American Bureau of Shipping.

Lloyd's Register of Shipping.

Refrigerating Machinery Association.

U. S. Department of Commerce, Bureau of Marine Inspection and Navigation.

U. S. Maritime Commission.

U. S. Navy—Specifications 44-T-42 and 44-T-11.

They also are covered by A. S. T. M. Specifications A-178, A-226, A-249, A-250 and A-214 — and by Federal Specification WW-T-731.

If you would like to know more about Republic ELECTRUNITE Tubes, write—

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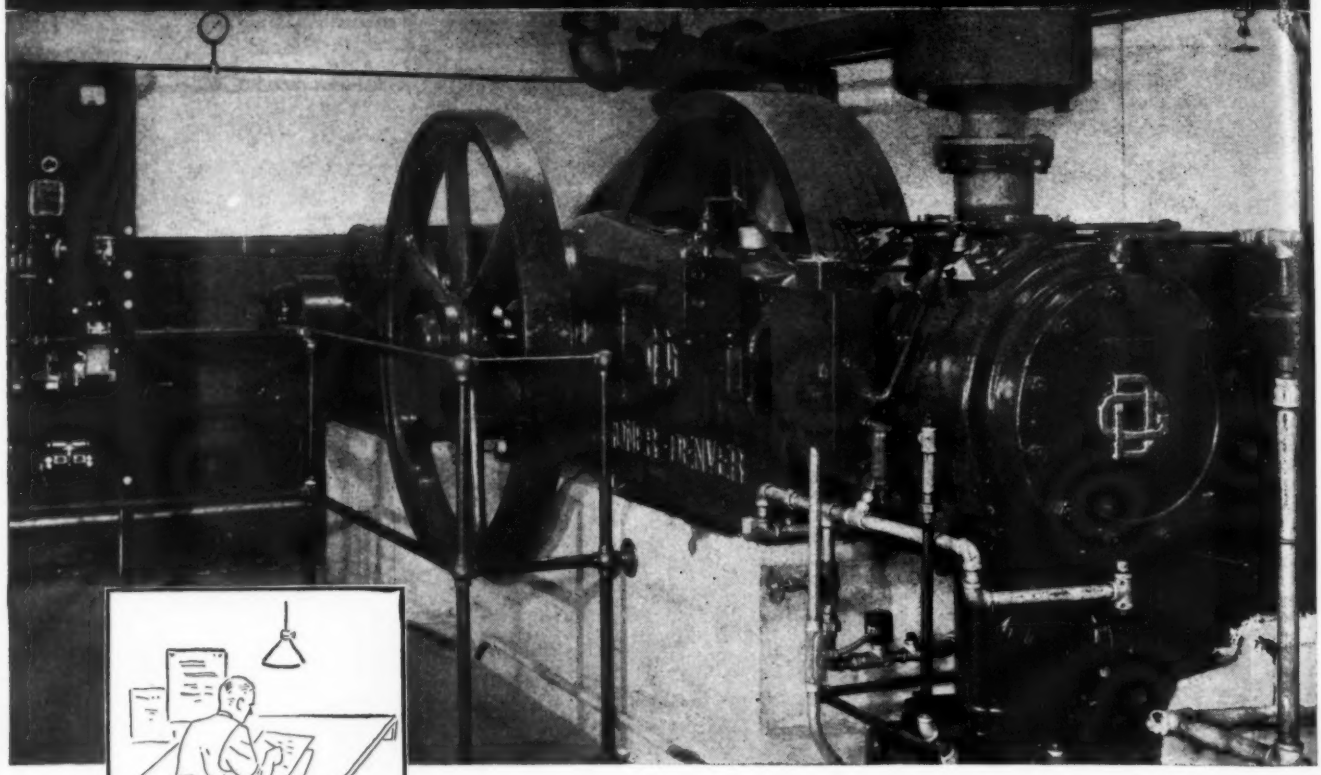
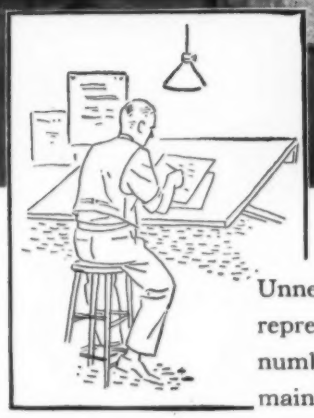
BOILER, CONDENSER AND HEAT EXCHANGER TUBES

One Good Way to Simplify MAINTENANCE RECORDS





Unnecessary maintenance records are not only a nuisance in themselves—but they represent expended time—money and man-hours. One good way to cut down on the number of maintenance records you keep is to have equipment that requires little maintenance. That's why so many Victory plant engineers are thankful that their compressed air source is the rugged and reliable Gardner-Denver "RX" compressor.

"RX" single-stage horizontal air compressors are staunch machines that take the 24-hour day in stride—yet their horsepower requirements remain unusually low.

Obsolete machinery foundations — walls — etc., are more quickly demolished when the crew is equipped with powerful Gardner-Denver B-72H Paving Breakers. The B-72H is a hard-hitting tool, delivering slow, heavy blows.

THEIR HIGHER EFFICIENCY AND EXTRA DEPENDABILITY ARE THE RESULT OF DESIGN FEATURES LIKE THESE:

1. Long service assured by rugged, dirt-free construction.
2. Increased efficiency due to large and unrestricted valve and port areas and extra large water jackets.
3. "Air-Cushioned," silent Duo-Plate valves virtually eliminate valve breakage—actually become tighter with use.
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Write for a descriptive bulletin containing complete specifications. Gardner-Denver Company, Quincy, Illinois.

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Of reports turned in over the past 13 years dealing with steam saving secured by Armstrong Trapping, those that give figures show savings of 13 to 50%, with an average of 38.5%.
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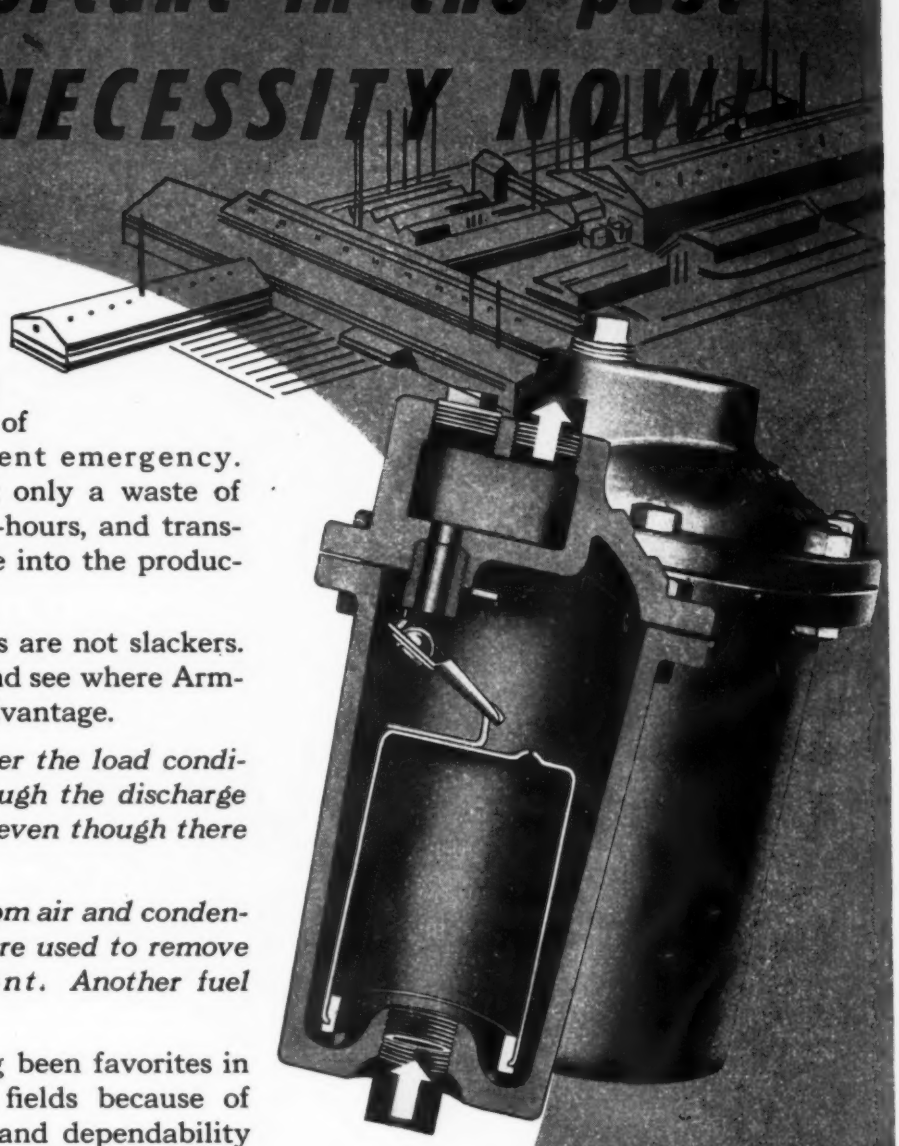
STEAM TRAP

highly important in the past—
A VITAL NECESSITY NOW!



CONSERVATION of coal through steam saving is of vital necessity in the present emergency. Wasted steam represents not only a waste of resources, but of money, man-hours, and transportation miles that have gone into the production and distribution of coal.

Make sure your steam lines are not slackers. Check over your equipment and see where Armstrong traps can be used to advantage.

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NO PRODUCTION LOSS *from air and condensate, when Armstrong traps are used to remove them from process equipment. Another fuel saving!*

Armstrong traps have long been favorites in power, heating and process fields because of their simplicity, efficiency and dependability over long periods. An Armstrong Representative will be glad to tell you more about them and help you with your trapping problems.

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Write for the Armstrong Catalog, and the new Service Guide showing plant maintenance men how to get the most out of steam traps.

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BUT IT'S JUST AS SILLY TO HAVE TRAPS THAT LEAK STEAM, OR NO TRAPS AT ALL
HEY-MAN DON'T DO THAT!
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STEAM TRAPS

The new K type Navy blimp is able to fly at 80 miles per hour or to hover motionless over a lurking submarine. These airships have proved an efficient answer in protecting coastwise shipping against the undersea menace.

★★★ *Guardian Angel* OF THE CONVOY

Swinging majestically over the convoy, the blimps are proving an effective answer to the submarine menace. Sinkings have been practically eliminated in convoys so guarded.

Able to scan the ocean for miles, able to see below the waves, able to hover over the slowest tanker, or to fly at many times the speed of the fastest wolf pack, these guardian angels of the fleet owe much of their effectiveness to the engines that power them.

And in these Pratt and Whitney engines, as in every part of the ship, weight is a vital factor. To produce gears of the necessary lightness—of the extreme precision that this lightness, coupled with tremendous horsepower, demands—meant a new conception in gear manufacture. Today, these gears are being produced at Foote Bros. in amazing quantities.

The new manufacturing techniques, new production know-hows that make these lightweight, high-precision gears possible, will mean better performance and greater operating efficiency when they are applied to peacetime machines.

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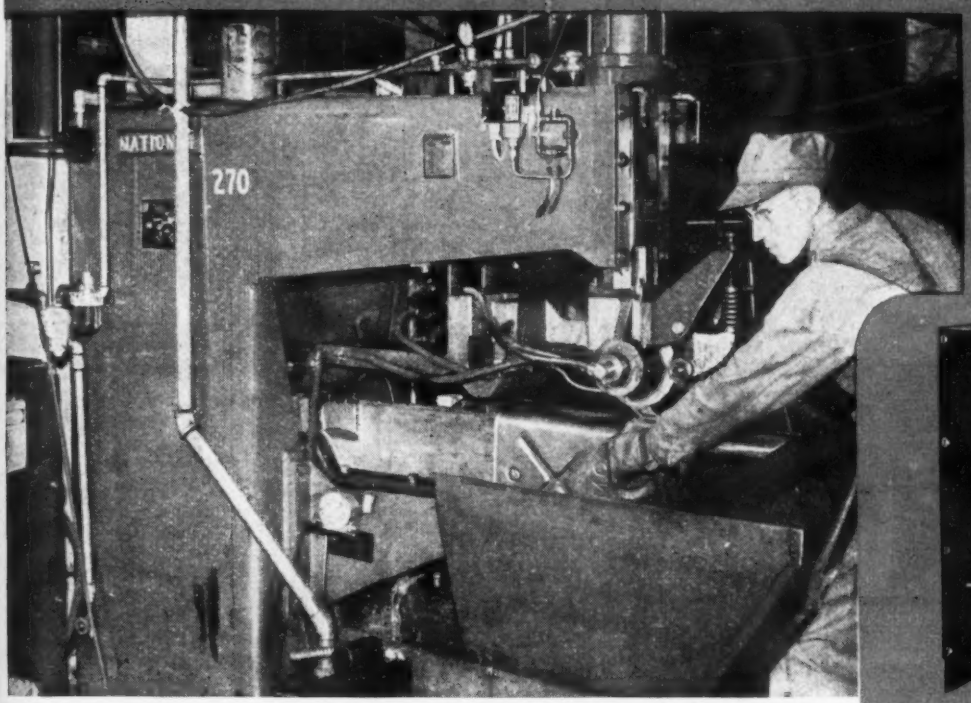
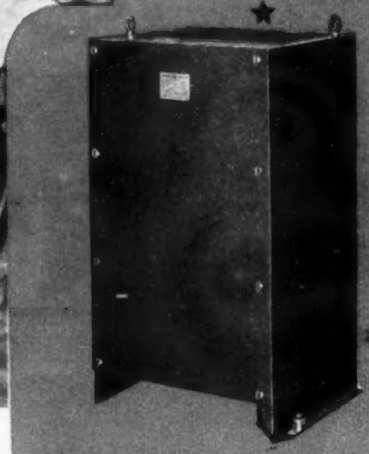
Better Power Transmission Through Better Gears

TO REDUCE KVA DEMAND OF RESISTANCE WELDERS

USE G-E PYRANOL CAPACITORS





Series-capacitor equipment for improving power factor of resistance-welding machines

The Conco Engineering Works, Mendota, Ill., reduced the kva demand of this welder from 150 kva to 54.6 kva by installing series capacitors (partly shown at left). A serious wiring and power-factor problem within the factory was solved, and a bad light flicker in town was eliminated. The capacitors added only 14 per cent to the installed cost of the welder.

PROBLEM

Welding loads present a problem to both resistance-welding machine users and utility companies. First, because the power demand is high, and the power factor is low. Second, the load is single phase, causing unbalance on polyphase systems. Third, the duty is highly intermittent, causing light flicker.

SOLUTION

Capacitors can be used in series with the primary of the welding transformer to reduce kva demand from the line by improving power factor to approximately unity.

RESULTS

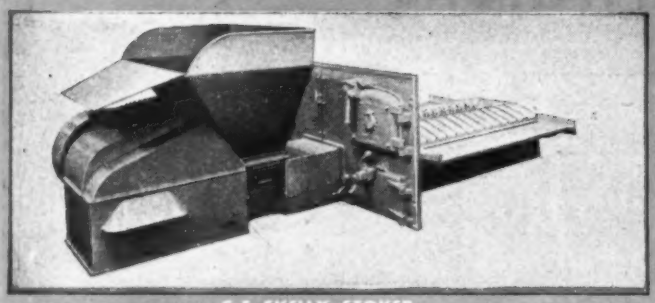
- **More welding machines can be used on an existing feeder.**
- **Heavier welds are possible on the feeders where capacitors have been installed.**
- **Reduced interference with other welders on the same feeder.**
- **Welding machines can be installed on feeders too small to supply the usual low-power-factor machines.**
- **Removal or lessening of the restrictions sometimes required by power companies.**
- **Reduction of light flicker.**
- **Smaller feeder and power-supply equipment are needed for new welders.**
- **The necessity of running a separate feeder for a welder can probably be avoided.**
- **Special, low-impedance, power-supply transformers are not necessary.**
- **Long-throat machines will have practically the same kilowatt demand as short-throat machines.**

Application information can be obtained by asking for Bulletin GET-1134. For specific recommendations call your G-E representative. He'll be glad to help you. General Electric, Schenectady, N. Y.

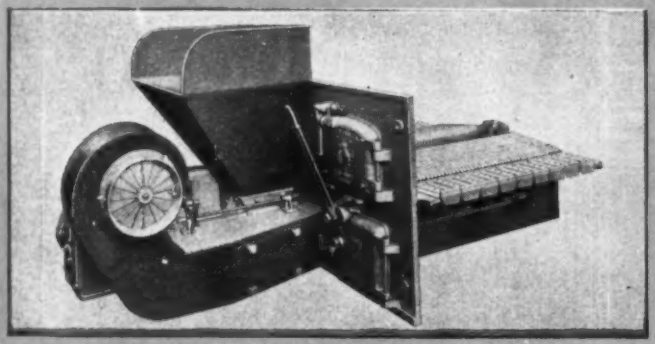
GENERAL ELECTRIC

607-54-5700

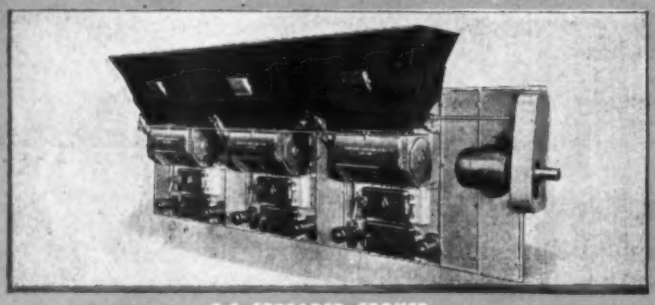
200,000,000 GALLONS



C-E SKELLY STOKER

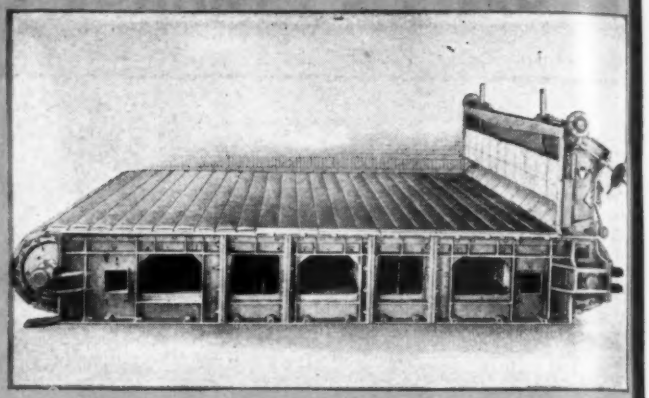


C-E LOW RAM STOKER

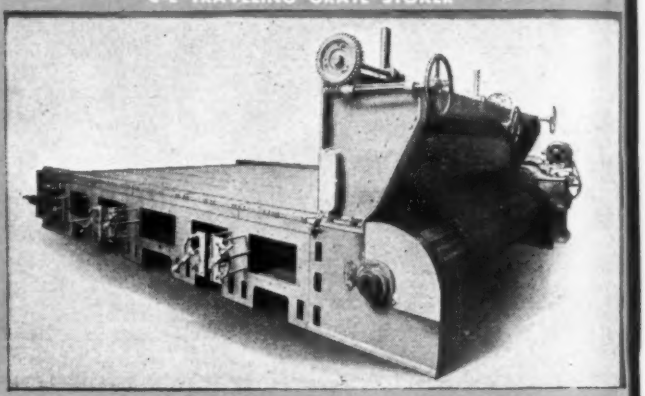


C-E SPREADER STOKER

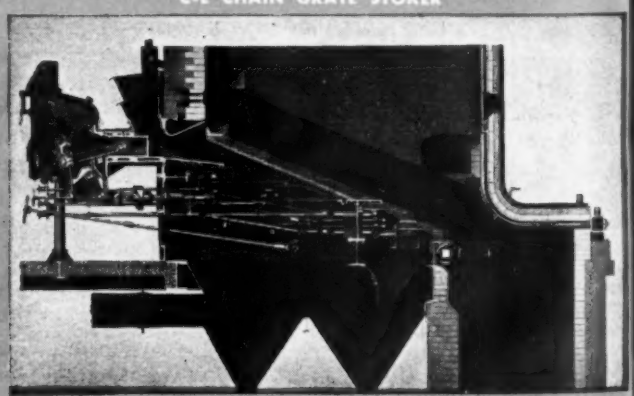
C-E TYPE E STOKER



C-E TRAVELING GRATE STOKER



C-E CHAIN GRATE STOKER



C-E MULTIPLE RETORT STOKER

OF FUEL OIL A YEAR!

saved by C-E Conversions

As of July 1st, C-E orders for conversion installations represented an aggregate annual saving of well over 200,000,000 gallons of oil. And this figure is based on conservative assumptions as to rates of operation and hours in service.

What this means in the conservation of today's most vital natural resource may be judged from the fact that the transportation of this quantity of oil would require about 20,000 tank cars, or, to put it another way, it represents the saving that would be achieved by converting some 135,000 average homes from oil to coal firing.

All Types of Fuel Burning Equipment

Although the big majority of these C-E conversion installations consist of single-retort underfeed stokers, such as the Skelly, Type E and Low Ram, they include all the other types of C-E Stokers illustrated on the opposite page, as well as C-E Pulverized Coal Systems.

This fact is emphasized because it reveals one of the chief advantages of calling on C-E to help you with your conversion problems. Like the hundreds of plants which have already taken this step, you will be sure of getting the best type of fuel burning equipment for your particular conditions. Why? Because C-E has the most extensive line of fuel burning equipment offered by any manufacturer and correspondingly broad experience . . . experience based on the equipping of over 5,000,000 boiler horsepower with stokers of all types.

A Point to Remember

And, if you are going to convert, here's an important point to remember. Your coal burning installation can be a source of substantial saving to you not only for the duration but for many years thereafter. So don't regard it as a temporary expedient but rather as a long-term investment that will yield you returns in direct proportion to the quality of the equipment you buy and its suitability for *your* plant.

It may still be possible to complete your conversion before cold weather if you act now. Write, phone or wire C-E today. Your inquiry will be referred to the district office nearest you for immediate attention.

A 745

COMBUSTION ENGINEERING

200 MADISON AVENUE, NEW YORK, N. Y.

Canadian Associates

COMBUSTION ENGINEERING CORPORATION, LIMITED

Montreal • Toronto • Winnipeg • Vancouver

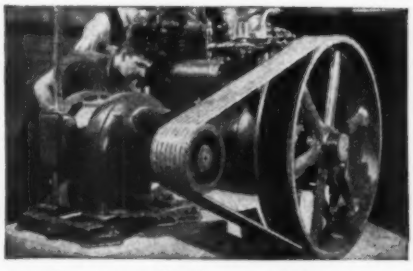
Good Team
Great Team

ALLIS-CHALMERS MOTORS AND

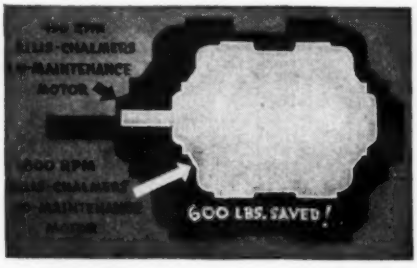
☛ **Using high-speed motors with Allis-Chalmers Texrope Drives and single-speed motors with Allis-Chalmers Vari-Pitch Sheaves and Speed Changers has always been good practise.** ***In time of war it's a vital practise!***

☛ **Such combinations give sharply higher efficiencies—at lower cost in man-hours, money and materials!**

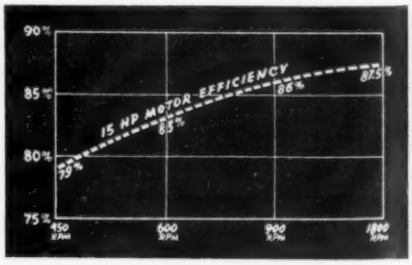
☛ **Allis-Chalmers, only builder of *both* motors and V-belt drives, offers invaluable know-how in teaming them up.**



1 In most applications, an 1800 rpm motor with Texrope Drive will ably do the job of a lower-speed, direct-connected motor —at lower cost in money *and materials!*



2 When you buy an 1800 rpm instead of 450 rpm 15 hp squirrel-cage motor, for example, 600 lb are saved. And *you* save well over $200 — with drive figured in!



3 Note that efficiency rises from 79% for the 450 rpm motor to 87.5% for the 1800 rpm motor. The 1800 rpm motor saves you over 30 kw/24 hr. day.

WE WORK FOR VICTORY — WE PLAN FOR PEACE

ALLIS-

in Peace . . . in Wartime!

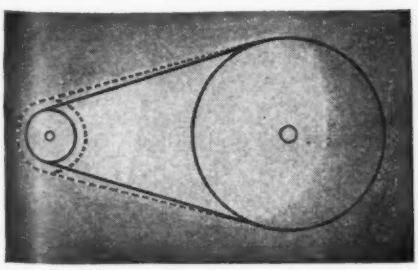
TEXROPE DRIVES

IT'S TIME to take a *fresh* look at motor buying! See below how much you can save with high- and single-speed motors made flexible by Texrope Drives.

Allis-Chalmers, builder of Lo-Maintenance Motors, originated the multiple V-belt drive and Vari-Pitch Sheaves . . . is the only manufacturer building *both* motors and V-belt drives. You benefit when you ask for — and get — the *right* combination of Lo-Maintenance Motor and Texrope Drive!

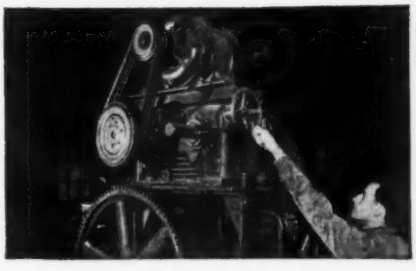
Call on your nearby Allis-Chalmers district office for facts, figures and advice — or write direct to ALLIS-CHALMERS MFG. CO., Milwaukee 1, Wis.

A 1627



4 Infrequently needed speed changes can be had by changing from one size motor sheave to another. Juggling *complete* drives, range is 1:1 to 7:1.

5 With the Allis-Chalmers Vari-Pitch Sheave, you can increase or decrease speed by adjusting sheave diameter . . . obtaining an *unbroken* series of speeds!



6 Allis-Chalmers Vari-Pitch Speed Changer gives you infinite changes at the turn of a wheel — within 3.75 to 1. It's compact, flexible, *efficient!*

CHALMERS

LO-MAINTENANCE MOTORS
TEXROPE DRIVES

LAUNCHED WITH *Steam up!*

SIDE-LAUNCHED with boilers and engines installed, *and with steam up,* this Liberty ship is practically ready to sail. Furnishing power for hundreds of Liberty ships in America's wartime shipbuilding program is a vitally important job of reciprocating engines.

Afloat or ashore...whatever the operating temperature or pressure...reciprocating steam engines everywhere, both old and new, are maintained at maximum efficiency...lubricated with *Texaco Steam Cylinder Oil.*

Texaco Steam Cylinder Oils atomize completely, adhere to cylinder walls, separate rapidly from the exhaust; assure quiet operation, low oil consumption.

TUNE IN THE TEXACO STAR THEATRE EVERY SUNDAY NIGHT—CB

So effective have Texaco lubricants proved that they are definitely preferred in many important fields, a few of which are listed in the panel.

A Texaco Lubrication Engineer will gladly co-operate in selecting the most efficient steam cylinder oils for your plant... just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write to The Texas Company, 135 East 42nd Street, New York 17, N. Y.

THEY PREFER TEXACO

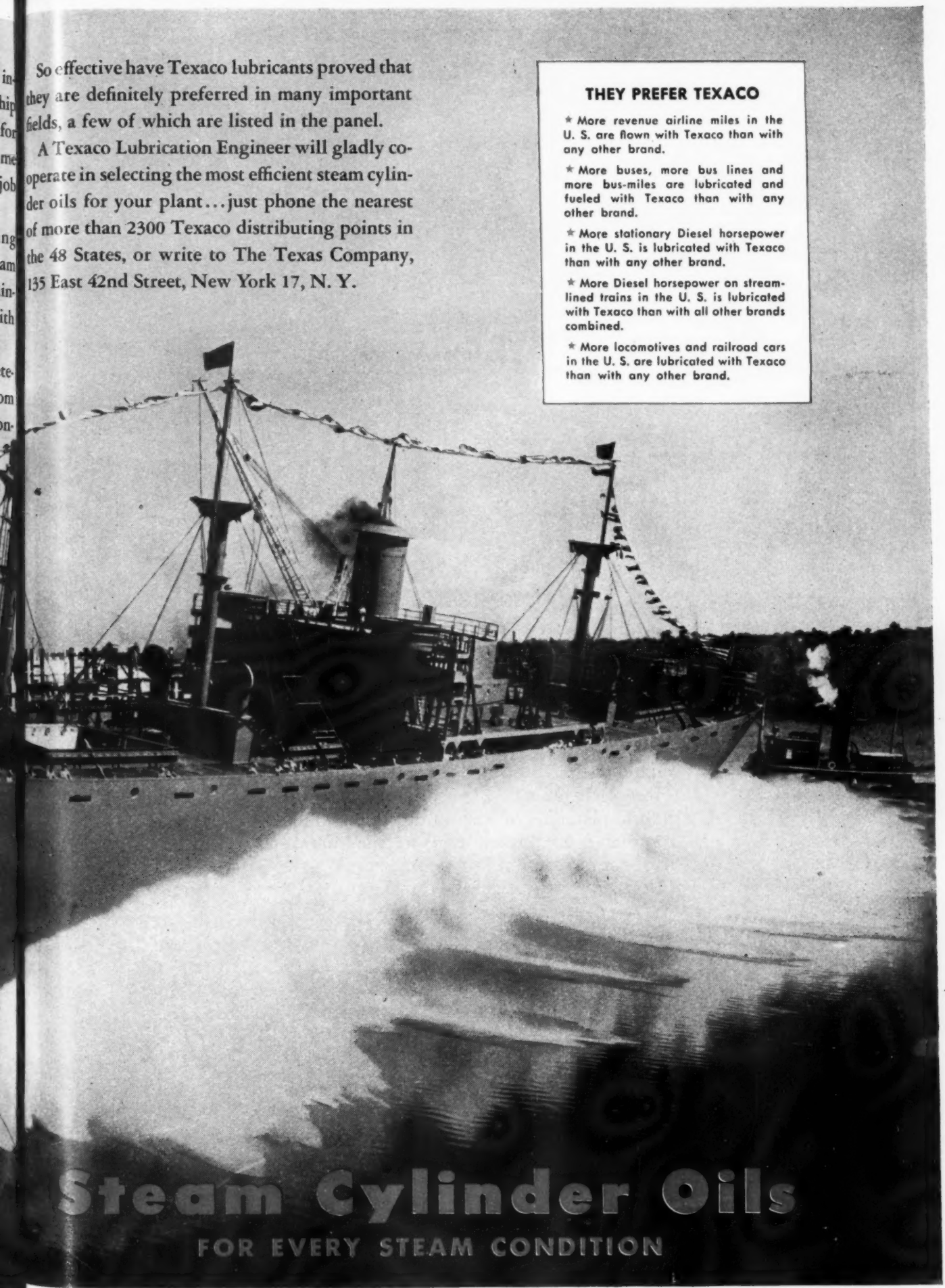
★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated and fueled with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

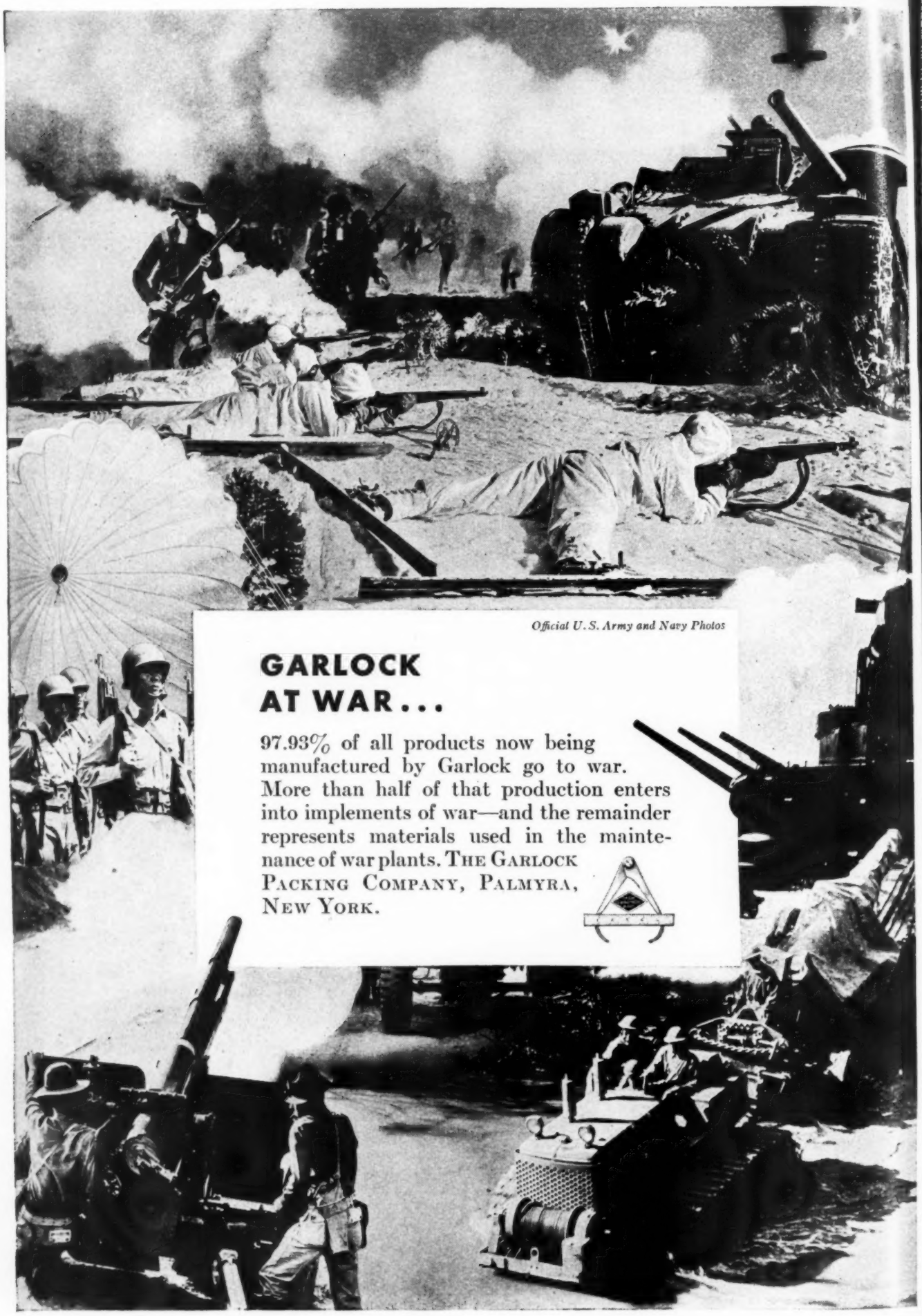
★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.



Steam Cylinder Oils

FOR EVERY STEAM CONDITION



Official U. S. Army and Navy Photos

GARLOCK AT WAR...

97.93% of all products now being manufactured by Garlock go to war. More than half of that production enters into implements of war—and the remainder represents materials used in the maintenance of war plants. THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK.

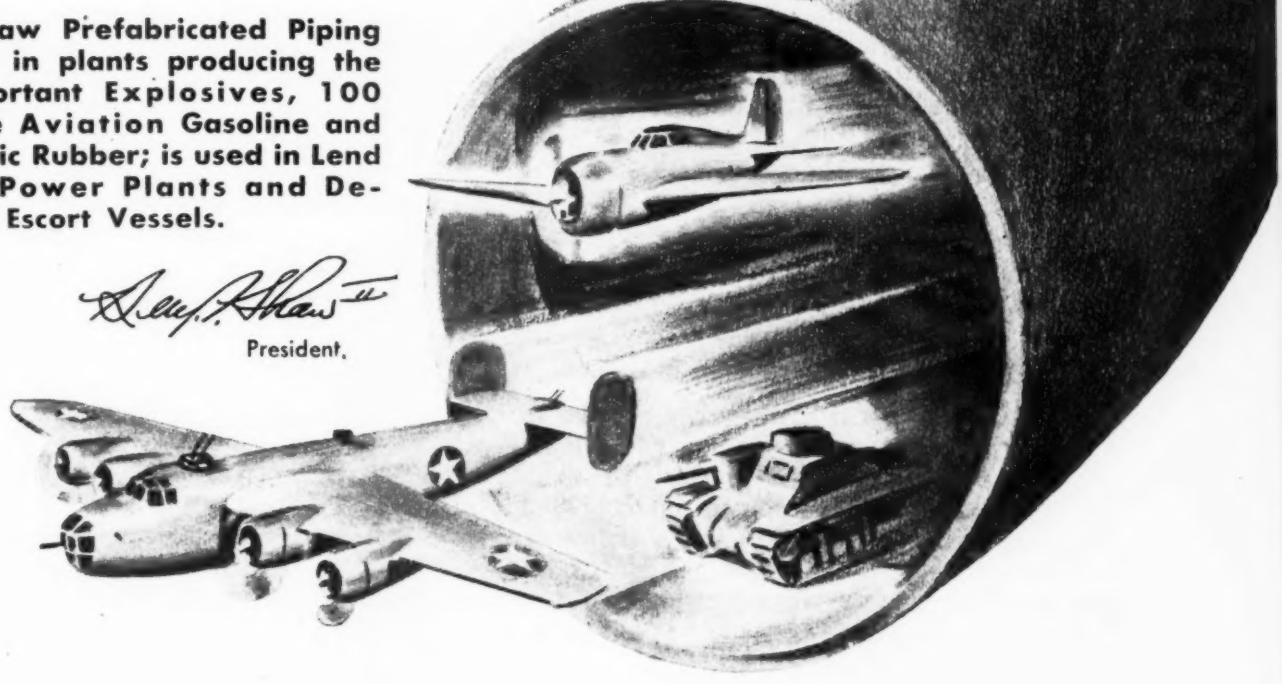
SHAW PREFABRICATED PIPING

At Shaw, we are pleased to apply our skill, experience and full production time in prefabricating piping for war use.

This Shaw Prefabricated Piping is used in plants producing the all-important Explosives, 100 Octane Aviation Gasoline and Synthetic Rubber; is used in Lend Lease Power Plants and Destroyer Escort Vessels.

Wm. P. Shaw II

President.



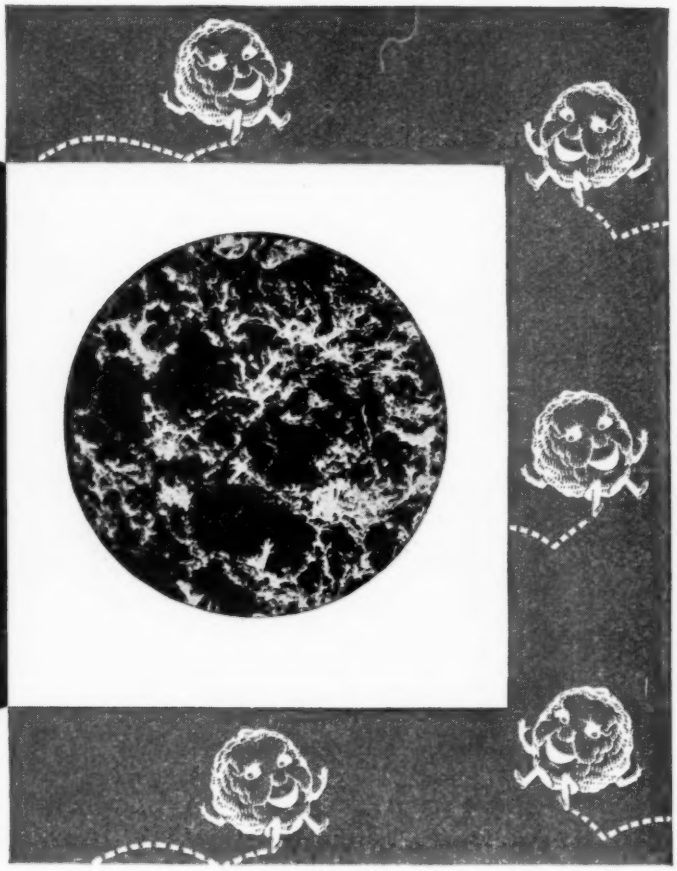
50th Anniversary Year

BENJAMIN F. SHAW COMPANY

2nd & Lombard Streets Wilmington, Delaware

FACTS YOU MAY NOT KNOW ABOUT EAGLE MINERAL WOOL INSULATION

These dead air cells saved a million dollars!



You are *not* looking at a photo of the moon, but at a photomicrograph of a pinch of Eagle Mineral Wool Insulation, whose structure permits retention of an infinite maze of tiny air cells—air cells being the most efficient insulation known to science!

Not only one, but many millions of dollars have been saved to industry in recent years by the almost incredible efficiency of Eagle-Picher High Temperature Insulations which are made from Eagle Mineral Wool.

Eagle Super "66" Plastic Insulation

Most versatile insulation in the Eagle-Picher High Temperature line is Eagle Super "66" Plastic Insulation, an all-purpose cement. This product, for use on heated equipment up to 1800° F., trowels on easily, forming a tight one-piece coat.

High Thermal Efficiency

This unique insulation combines "springy balls" of Mineral Wool with long asbestos fibres to make a cement of great pliability and resilience. Dry coverage is 50-55 sq. ft. 1" thick per 100 lbs. Shrinkage is negligible from wet to dry. When used at temperatures up to 1200° F., Eagle Super "66" can be removed, remixed, reused!

Combats Rust, Corrosion

Furthermore — in itself non-corrosive, Eagle Super "66" actually helps prevent rust on the surface to which it's applied.

* * *

Write us for complete information on Eagle-Picher High Temperature Insulations, address Dept. P43. Current demand is great, but we are endeavoring to fill all orders without undue delay.

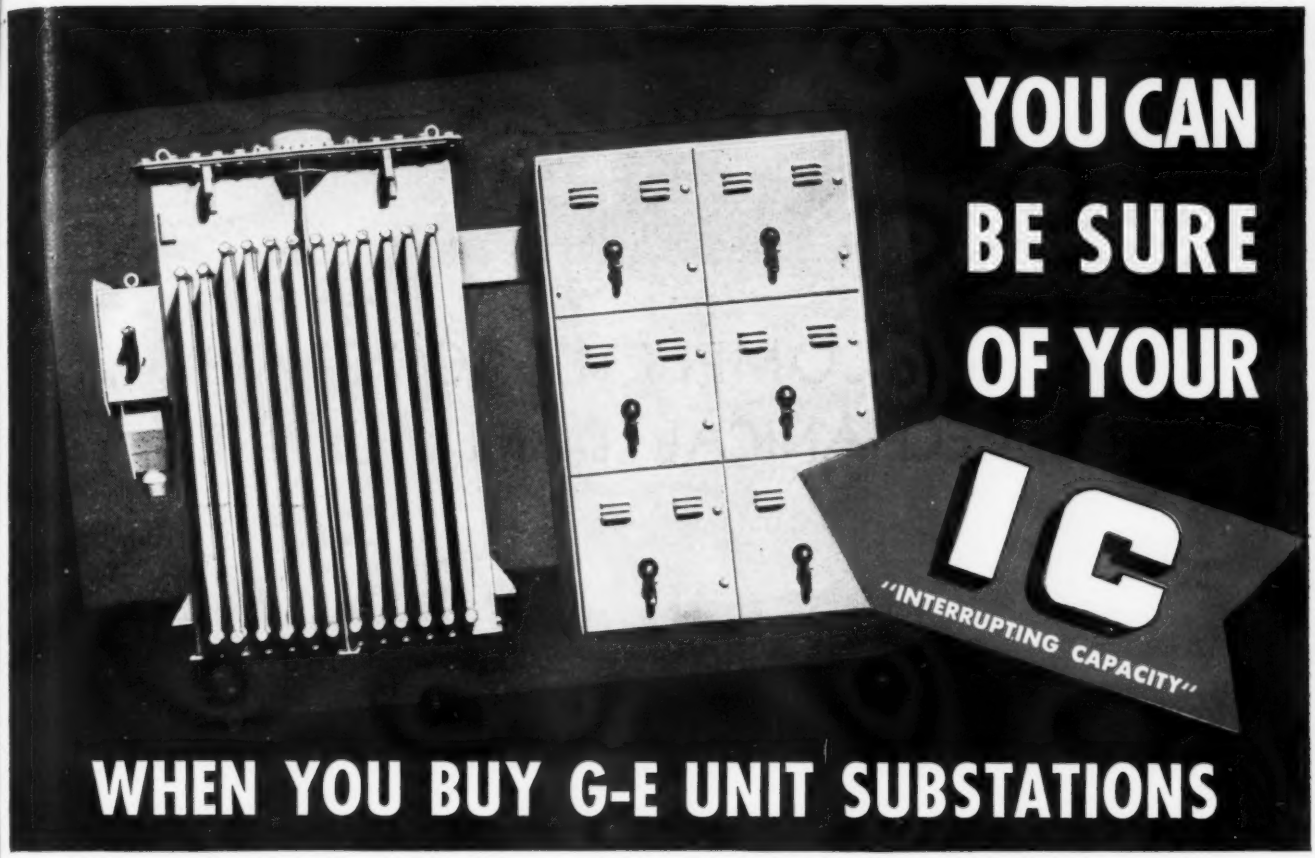
EAGLE-PICHER HIGH TEMPERATURE INSULATIONS

Eagle Super "66" Plastic Insulation
Eagle Supertemp Blocks
Eagle L-T Felts
Eagle Blankets

EAGLE 1843 EP 1943 PICHER

Eagle Finishing Cements
Eagle Loose Wool
Eagle Insulseal
Eagle Insul-stic

THE EAGLE-PICHER LEAD COMPANY, Cincinnati, Ohio



WHEN YOU BUY G-E UNIT SUBSTATIONS

The severity of a short circuit depends largely on the capacity of the substation that feeds the circuit, NOT on the normal load on the circuit. To assure you of ***adequate*** interrupting capacity for even the most severe short circuits, G-E load-center unit substations are built with ***properly rated*** breakers. These are air circuit breakers which have been co-ordinated—electrically, mechanically, and thermally—with the capacity of the substation and the system.

G-E drawout air circuit breakers are properly rated—can be inspected quickly and safely—and need little maintenance throughout a long life.

FOR DEPENDABLE PERFORMANCE—

G-E air circuit breakers have positive-acting, dual-magnetic, overcurrent trips which provide time-delay protection for overloads (adjustable from 100 to 200 per cent of the breaker rating), and instantaneous protection from short circuits. Silver-to-silver contacts, fast-acting arc quenchers, and generous current-carrying elements assure reliable operation.

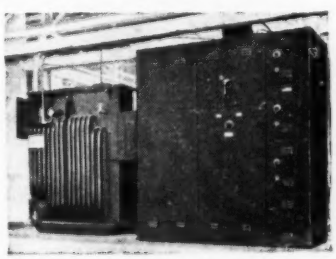
—AND EASY MAINTENANCE

Drawout air circuit breakers, which roll in and out as easily as a file-cabinet drawer, can be inspected, tested, or replaced with another breaker quickly and safely. After a power interruption, a simple turn of the breaker handle quickly restores service. Air circuit breakers in your G-E unit substation assure an important saving in time and labor required for routine inspection and maintenance.

If you need dependable load-center unit substations in a hurry, or simply want more complete information, get in touch with the nearest G-E office, or write to General Electric, Schenectady, N. Y.

FOR D-C, TOO—

RECTIFIER UNIT SUBSTATIONS



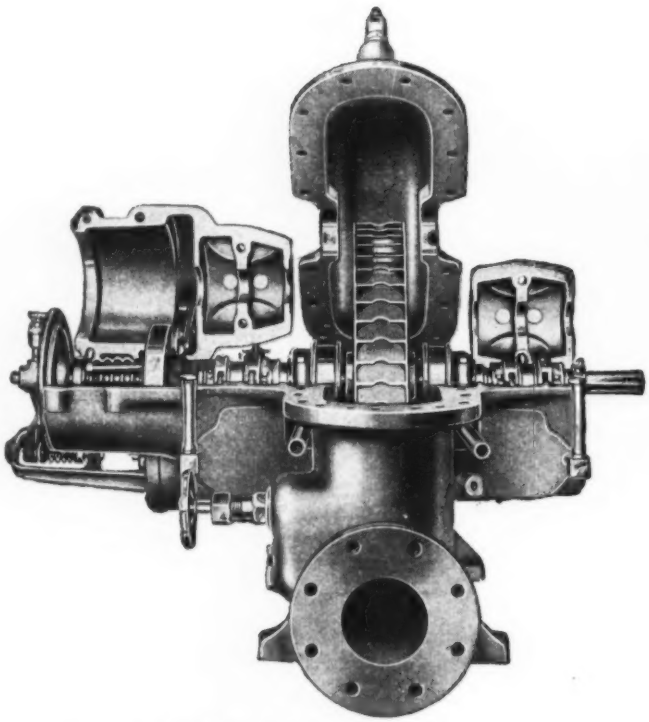
Now you can have direct-current power at your load centers by running high-voltage a-c all the way, and converting to d-c with rectifier unit substations located at those centers.

GENERAL ELECTRIC

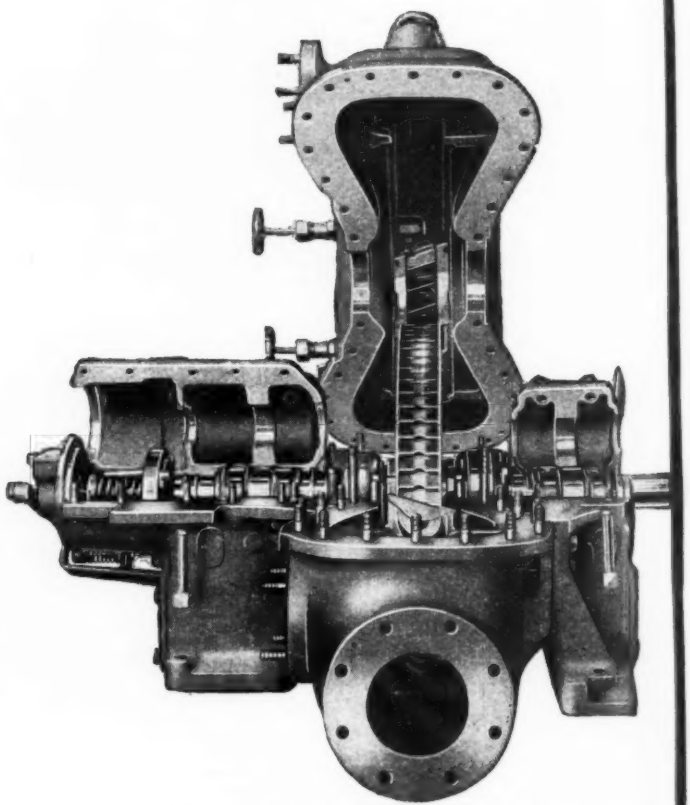
302-18-5900

The TERRY

OFFERS COMPLETE COVERAGE OF MECHANICAL DRIVE TURBINES



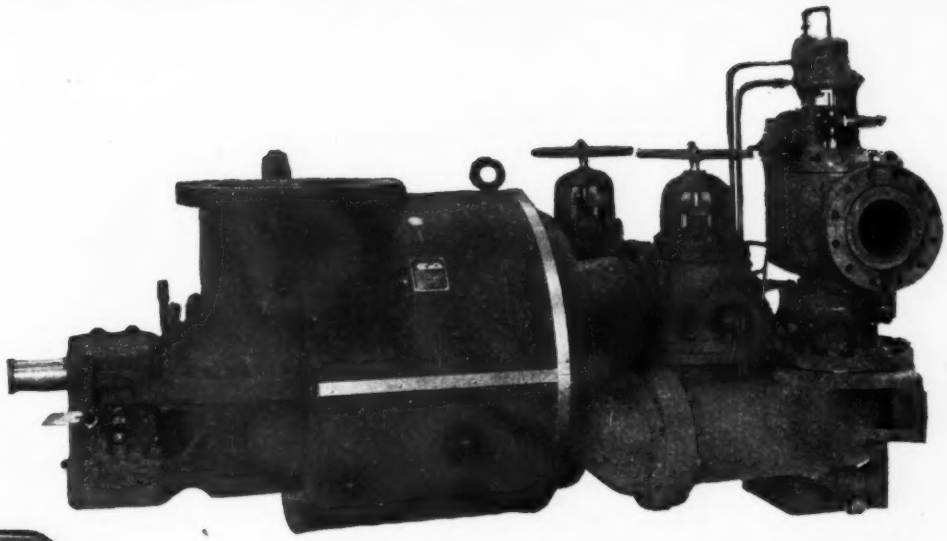
Terry Solid Wheel Turbine with Top of Casing Raised. Note the ruggedness and the ease with which the interior parts can be inspected — one of the country's leading oil companies employs 308 of these units for driving various types of refinery pumps. Full details are available in Bulletin S-116.



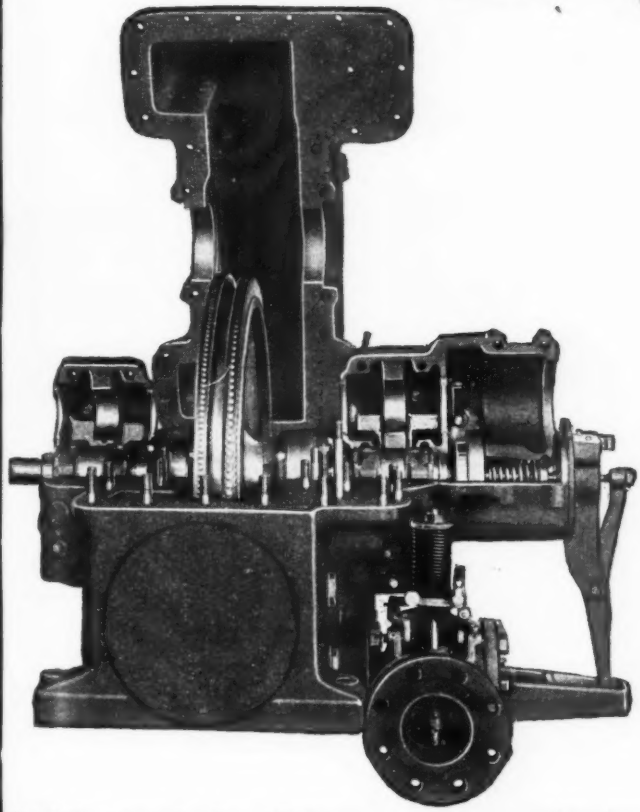
Twelve Terry Solid Wheel Turbines, similar to the above unit, drive auxiliaries in the power house of an east coast refiner. They operate with steam at 625 lbs. pressure — 700° Total Temperature. Eight of the machines exhaust against 125 lb. back pressure. The first of these units was purchased in 1931. It proved entirely satisfactory so that as the plant was enlarged, duplicate Terry's were added. Bulletin S-99.

THE TERRY STEAM TURBINE CO.

TURBINE



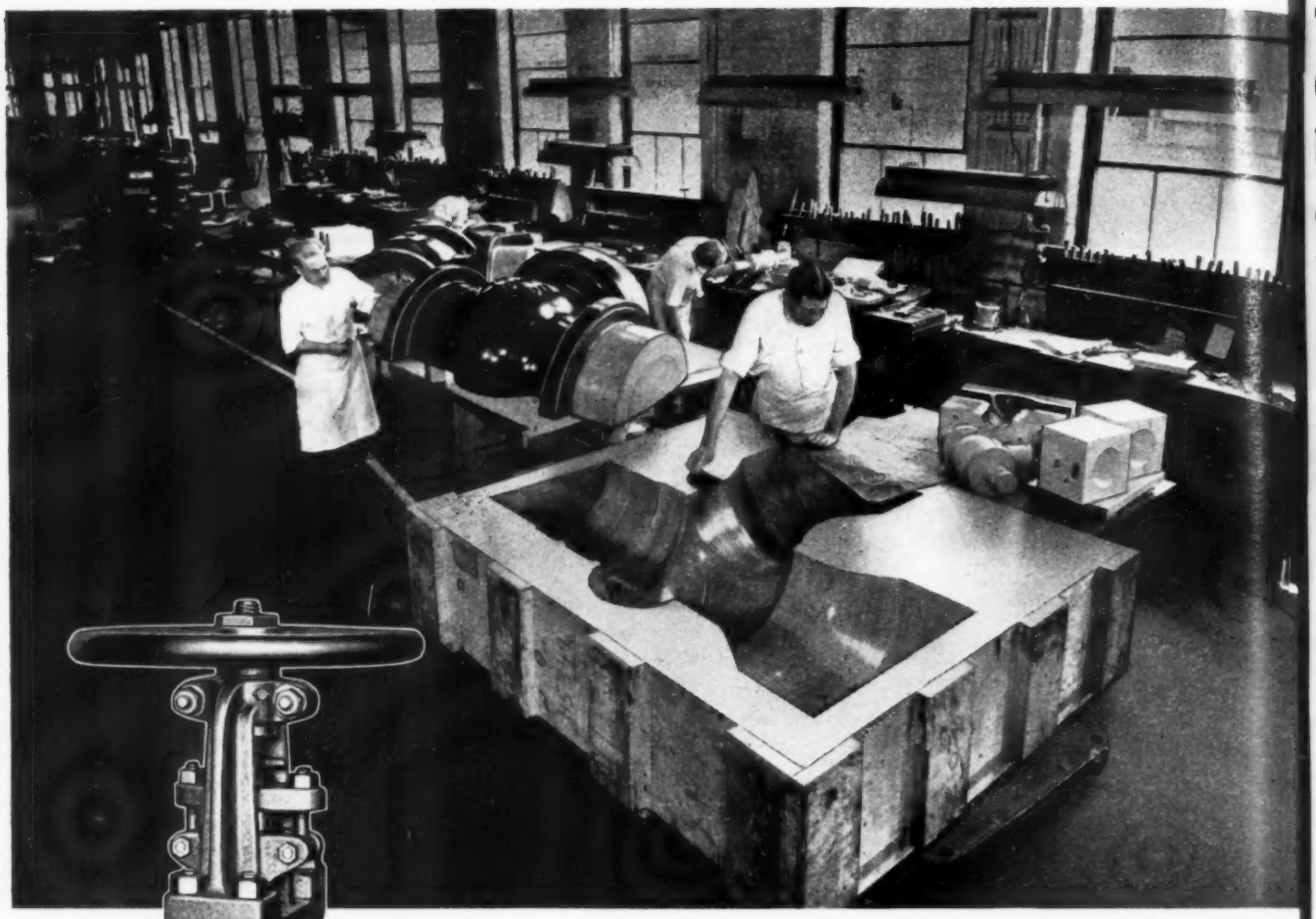
1200 Horsepower Terry Multi-stage Turbine. Units of this type are employed extensively for driving large refinery pumps. The units may be designed for non-condensing, condensing, mixed pressure, or bleeder operation. They may be equipped with constant speed or variable speed governors, remote speed controls or with special governors to meet unusual requirements. Ask for Bulletin SR-114.



Axial Flow Impulse Terry Turbine — one of a complete line — built with either two or three rows of blading. These units, like all Terry turbines, are the result of over 45 years of successful experience in the manufacture of turbine drives exclusively. Completely described in Bulletin S-107.

T-1151

TERRY SQUARE - HARTFORD, CONN.



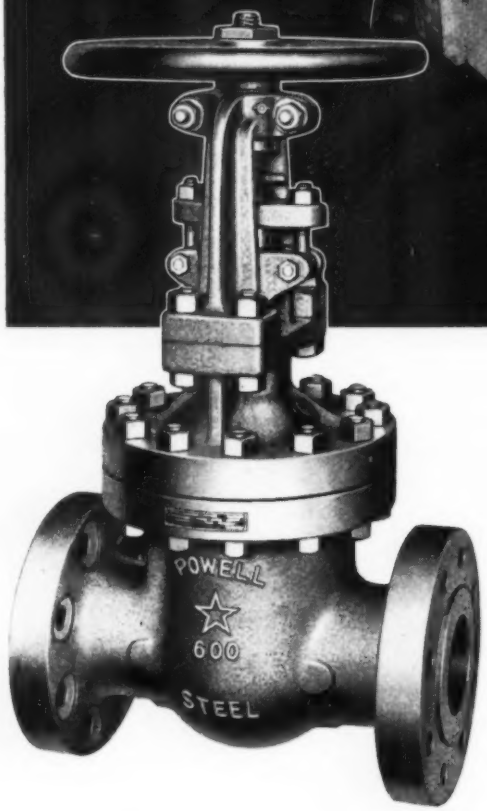


Fig. 6003—A Class 600-pound Cast Steel Gate Valve. Has flanged ends, outside screw rising stem, heavy bolted flanged yoke bonnet, and taper wedge solid disc. Available in sizes from 1" to 24", inclusive. Made also with welding ends.

Cradle of Industry— in the POWELL Line

Because the design of the Powell Valve Engineer is cradled into practical, serviceable reality by the skilled hands and practiced eye of the Powell Pattern Maker . . .

Because every POWELL Valve is nurtured from birth to installation by an almost century-old organization, whose business is making valves—and valves only—for Industry . . .

You buyers of valves are fully warranted in specifying POWELL Valves for all your flow control requirements, knowing that the POWELL name is your guaranty of pre-determined performance.

The Wm. Powell Company

Dependable Valves Since 1846

Cincinnati, Ohio

POWELL

The complete POWELL Line includes Globe, Angle, Gate, Check, Relief, Y, Non-Return and other types of valves in bronze, iron, steel, pure metals and special alloys to meet the demands of all branches of Industry for DEPENDABLE FLOW CONTROL EQUIPMENT.

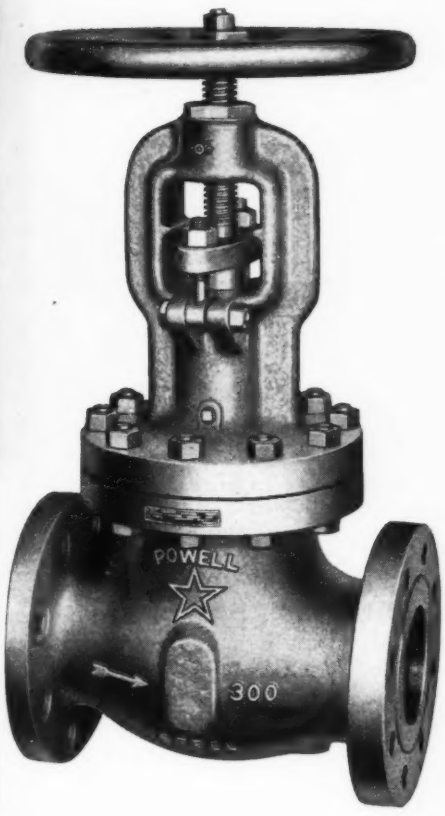
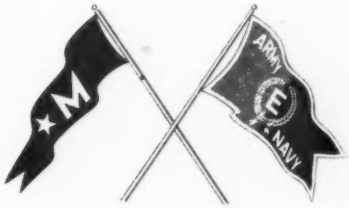
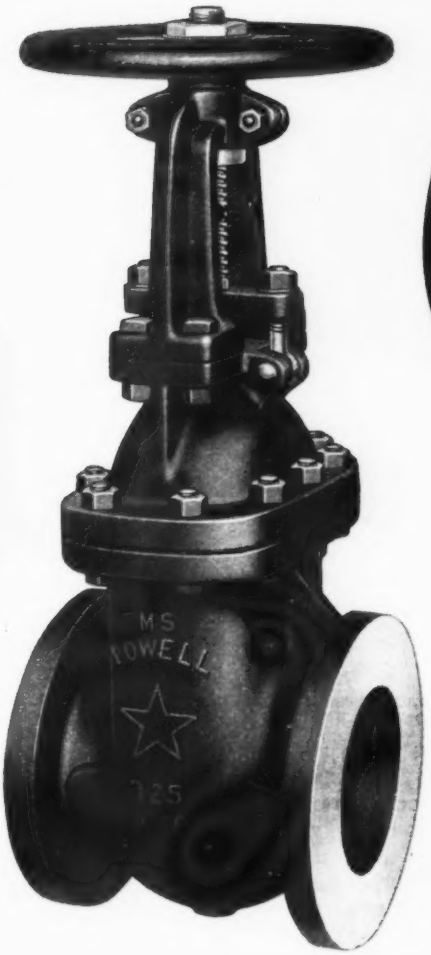


Fig. 3031—A Class 300-pound Cast Steel Globe Valve. Has flanged ends, outside screw rising stem, bolted flanged yoke bonnet, and plug type seat and disc. Made in sizes 2" to 10", inclusive. Also available in angle pattern.





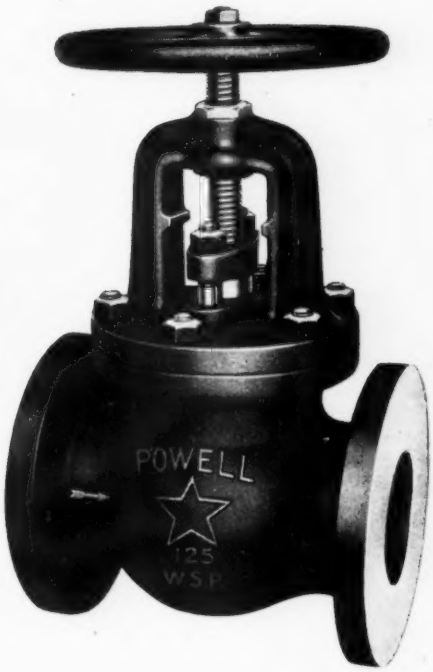


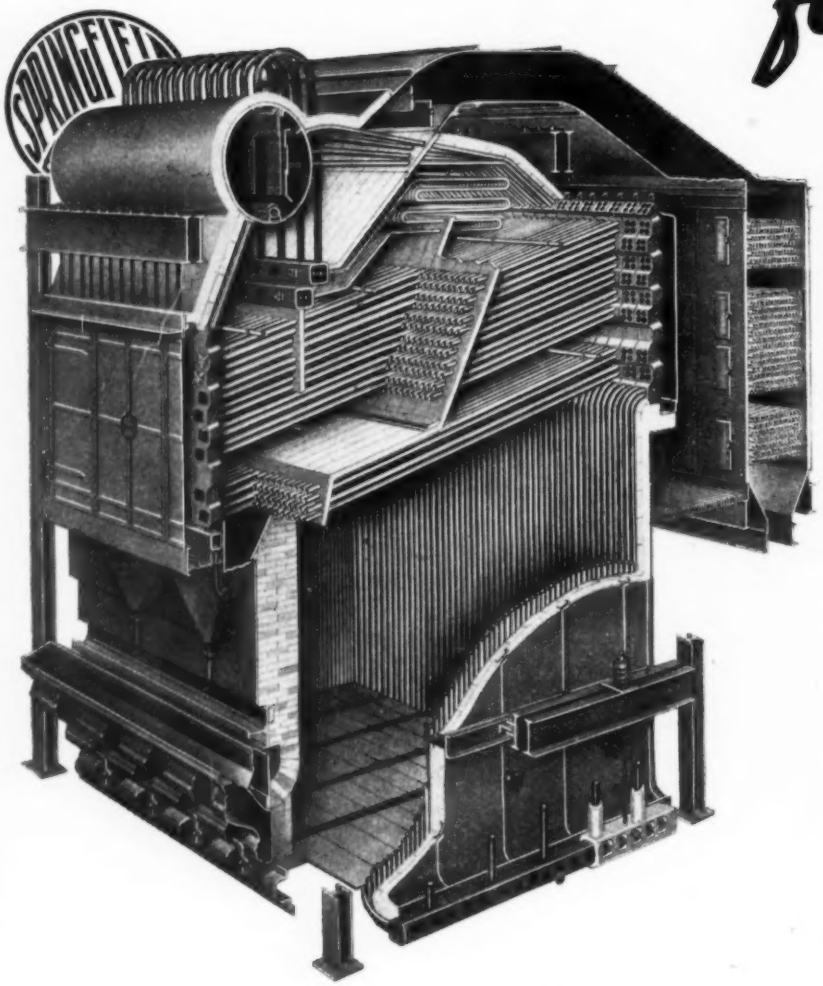
Fig. 241—A 125-pound Iron Body Bronze Mounted Globe Valve with flanged ends, outside screw rising stem, bolted flanged yoke and regrindable, renewable bronze seat and disc. Also available with screwed ends and in angle patterns.

Fig. 1793 (Left)—This large size 125-pound Iron Body Bronze Mounted Gate Valve has flanged ends, outside screw rising stem and taper wedge solid disc. Sizes 2" to 30", inclusive. Also available with taper wedge double disc in sizes 2" to 10", inclusive (Fig. 1444.)

VALVES

FEATURES THAT SAVE TIME!

30 to 60 Days Earlier Completion for War Plants!



ACTUAL records on recent war plant boiler installations reveal that Springfield's design and method of fabrication and erection has cut from 30 to 60 days off the time commonly required for completion of the boiler installation. This important advantage is made possible by several factors.

★ **SHOP ASSEMBLED SECTIONS.** Sections of 3" tubes rolled into rugged electric cast steel headers are assembled complete with baffles in our shop saving weeks or months in field construction time, depending on the size of the units. Water walls are also shop assembled where field conditions permit.

Each section is hydrostatically shop tested and inspected at pressure at least 50% over working pressure and never less than 500 lbs. Springfield's distinctive 4-tube grouping arrangement, combined with the sinuous headers gives each section rigidity and strength to withstand handling in shipping and in the field. Valuable time and labor savings, particularly on shipments going into overseas locations.

★ **COMPLETE 90% OF INSTALLATION BEFORE DRUM ARRIVES.** Delays in getting steel plates for drums is a minimum retardant on Springfield jobs. The setting can be put in, tubes, headers, water walls, auxiliaries installed—all before the drum arrives for connection.

★ **SINGLE DRUM.** A minimum amount of steel plate is diverted from shipbuilding and other urgent uses when the Springfield design is used. Cast steel, the material selected for turrets and hulls of newest Army tanks, has long been used by Springfield to produce better headers for boilers and water walls. With one size of straight boiler tube, Springfield averages about 1/16 fewer tube sizes than common bent tube boilers.

★ **DELIVERY.** Springfield shops are not loaded up with mass production of standardized boilers. Immediate attention can be given to units to meet the most special needs. Write, phone or wire for quotations. SPRINGFIELD BOILER CO., 1953 E. Capitol Ave., Springfield, Ill.

DUPLICATE UNITS

COMPLETE drawings, patterns, shop fixtures, etc., are on hand to duplicate any of the many modern Springfield steam generating units built in recent years. Capacities from 5,000 lbs. to 450,000 lbs. per hour, or more. Pressures from 75 lbs. to 750 lbs., or higher. Springfield regularly takes contracts for complete steam generating units.

SPRINGFIELD

STEAM GENERATING UNITS

SPRINGFIELD BOILERS

ANY SIZE ANY FUEL ANY PRESSURE

NICKEL AIDS THE FARM IMPLEMENT INDUSTRY

to KEEP 'EM SERVING!

America won a victory on the food front in 1942 with production that reached an all-time high. But even that wasn't enough to feed a hungry, war-torn world. So this year's objectives are higher.

Farmers need mechanical equipment to produce food in winning quantities. Now, with the critical shortage of skilled farm labor, modern machinery becomes vitally important.

Agricultural equipment engineers have steadily improved farm machinery, lowered costs, and educated users. Result: no nation's farms were ever so fully mechanized as ours. And repair and service facilities have kept pace so farm equipment keeps working without excessive breakdowns or delays.

The foresight of these engineers is shown by their repeated specification of materials strengthened and toughened with Nickel. Their experience proves that a little Nickel goes a long way in the manufacture of parts that stay on the job . . . stressed parts that stand shock overloads.

From tractor transmissions to plow discs, from cylinder liners to bull gears, Nickel teams up with other metals to assure the dependable performance of farm implement parts.

For years, the technical staff of International Nickel has been privileged to cooperate with the engineers and production men who are responsible for such great achievement in the improvement of farm equipment . . . equipment now working at top speed to feed the United Nations. INCO's staff of engineers and metallurgists offers counsel and data to all who seek assistance in the selection, fabrication and heat treatment of ferrous and non-ferrous metals.

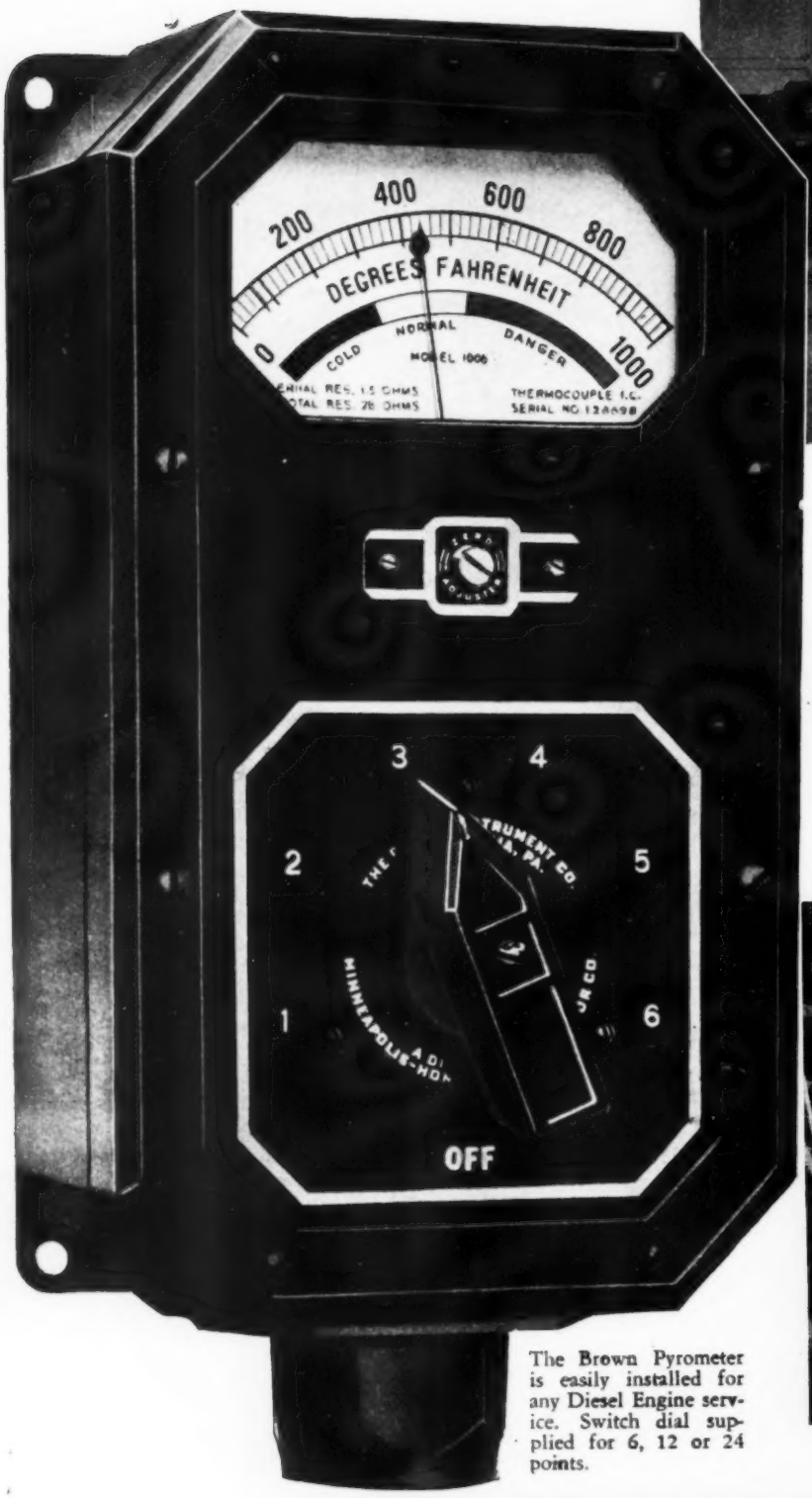
New Catalog Index

New Catalog C makes it easy for you to get Nickel literature. It gives you capsule synopses of booklets and bulletins on a wide variety of subjects — from industrial applications to metallurgical data and working instructions. Why not send for your copy of Catalog C today?

* *Nickel* *

THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall St., New York 5, N. Y.*

Exhaust temperatures of four Fairbanks Morse Diesels are accurately measured by Brown Pyrometers.



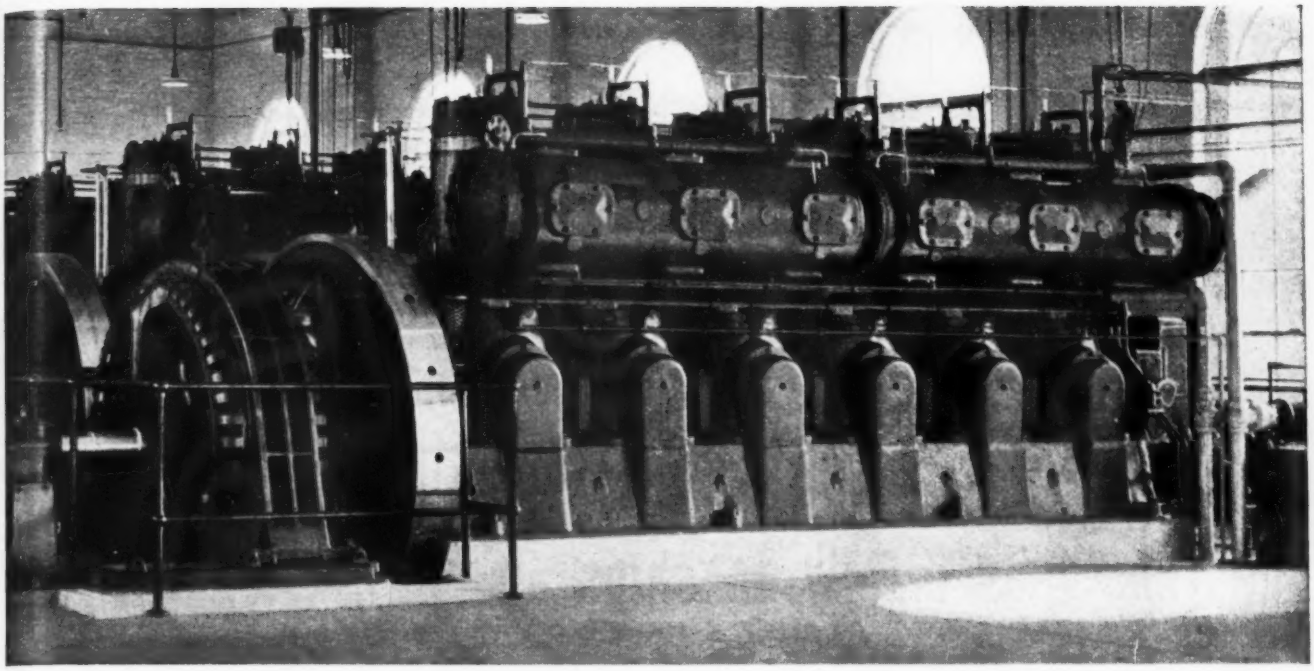
The Brown Pyrometer is easily installed for any Diesel Engine service. Switch dial supplied for 6, 12 or 24 points.

Right: Brown Diesel Thermocouple for long immersion.

Below: Brown Diesel Thermocouple for short immersion.

Brown Thermocouples in Cylinder Exhaust Headers of a 6 cylinder Diesel Engine.

BROWN DIESEL



MAXIMUM EFFICIENCY IS ASSURED

at Prince William Electric

WHEN the Prince William Electric Cooperative put into service its new $200,000 Diesel generating plant, one of the major Rural Electrification Projects of the East was brought a long step toward completion.

In selecting and arranging equipment, nothing was spared to make this plant a model of efficiency and ease of operation.

Each of the four Fairbanks Morse Diesels are equipped with Brown Diesel Pyrometers for checking exhaust temperatures.

A simple turn of the switch—a glance at the clear open dial—and instantly operators have an accurate check on the measurement of the load and relative efficiency of each cylinder. Clearly marked, colored zones on the dial indicate whether temperature is high, normal or low.

Compact and light in weight, the Brown Diesel Engine Pyrometer is built for rugged service — unaffected by vibration or adverse atmospheric conditions. The switch contacts are extra large to withstand hard usage.

Wherever Diesel Engines are used — in industry — in transportation — on the sea — in the air, Brown Pyrometers have earned the preference of exacting engineers and the leading builders of Diesel Engines, because of their accuracy, simplicity, ruggedness and dependability.

The saving in fuel alone has repaid the investment for Brown Pyrometers in many cases.

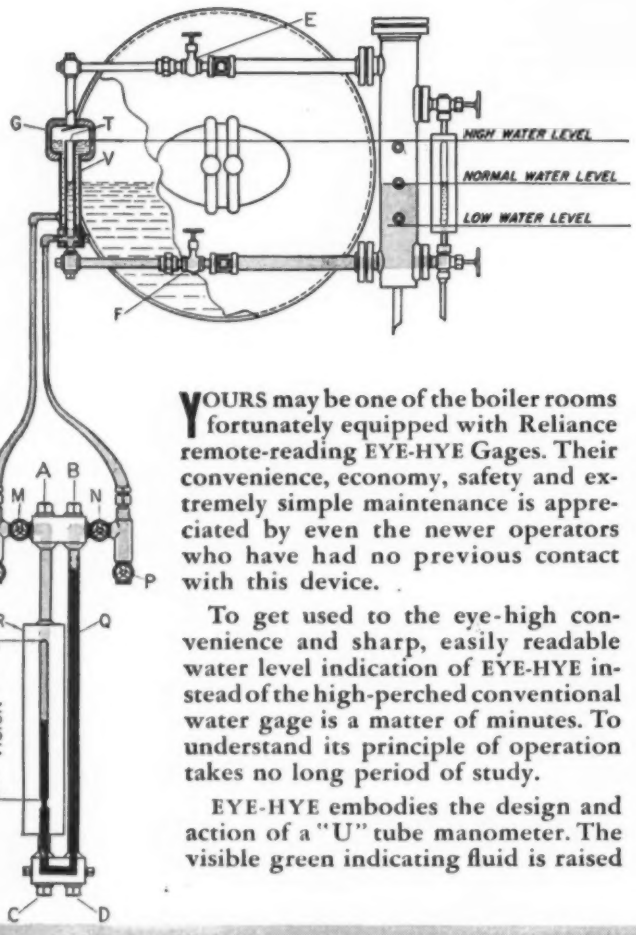
THE BROWN INSTRUMENT COMPANY, 4490 Wayne Avenue, Philadelphia, Pennsylvania, Division of Minneapolis - Honeywell Regulator Company, Minneapolis, Minnesota. Offices in all principal cities. 119 Peter Street, Toronto, Canada. Wadsworth Road, Perivale, Middlesex, England. Nybrokajen 7, Stockholm, Sweden.

ENGINE PYROMETER

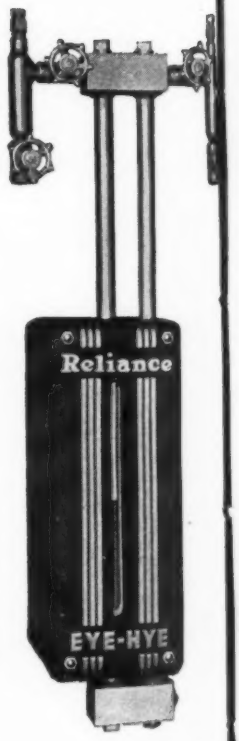
Simplicity OF OPERATION.

It's easy to keep your EYE-HYEs working perfectly while our new production goes mainly to ships

EYE-HYE Remote Reading Water Level Indicator



At left, the Unitemp, which maintains an even temperature in both hydrostatic legs, thus assuring accuracy of the EYE-HYE under all conditions... At right, *one model of the EYE-HYE.*



YOURS may be one of the boiler rooms fortunately equipped with Reliance remote-reading EYE-HYE Gages. Their convenience, economy, safety and extremely simple maintenance is appreciated by even the newer operators who have had no previous contact with this device.

To get used to the eye-high convenience and sharp, easily readable water level indication of EYE-HYE instead of the high-perched conventional water gage is a matter of minutes. To understand its principle of operation takes no long period of study.

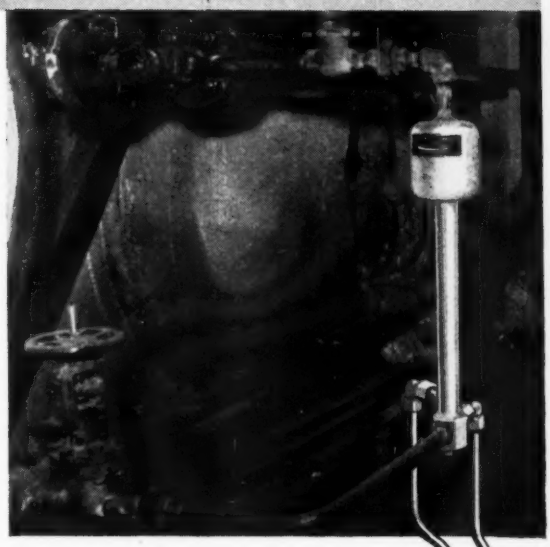
EYE-HYE embodies the design and action of a "U" tube manometer. The visible green indicating fluid is raised or lowered by a difference in hydrostatic head pressure generated by rising or lowering of water in the boiler. No deviation from accurate water level indication can occur, after correct installation. After a period of time it may be necessary to blow down to eliminate sedimentation in tubes and valves—a simple operation.

It's interesting to wide-awake engineers to know the "workings" of the devices and controls they have to deal with. By means of the diagram reproduced here, Reliance Bulletin 382-C explains EYE-HYE in detail. And Form 425, shown on opposite page, not only covers installation procedure but gives full instructions for maintenance.

Since 1884

Reliance

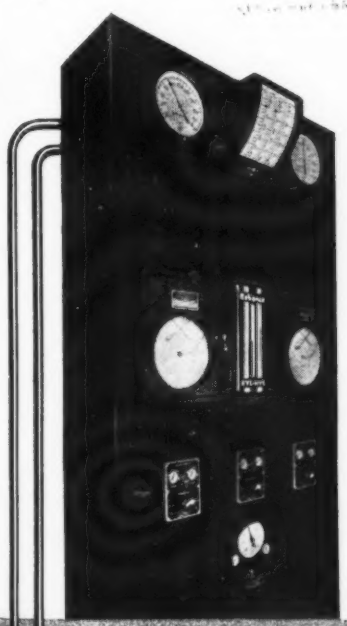
Flexibility OF PLACEMENT



If your EYE-HYEs aren't as conveniently located as you'd like, these installation "kinks" will help you

WHENEVER Reliance advertising has described the EYE-HYE for you, it has stressed flexibility of placement — that is, *EYE-HYE can be placed at any convenient point,* with very few restrictions.

Since flexible tubing is the connecting medium, you can bend the tubes around corners, girders, piping, other equipment — running them any reasonable distance from the drum to the location you select for the EYE-HYE. The gage window should be eye height, or about 5 feet from the floor. It can be placed on a wall, on a girder, on a specially constructed panel, or planned to fit flush on your instrument panel.



If the present location of your EYE-HYE isn't what you'd like, it's no trick to change it. You can even place it *above* the boiler drum (more likely required for heater tanks and other vessels) if you follow simple rules. For the engineer who strives for efficiency and safety in locating wiring and piping, EYE-HYE's connecting tubes can be run under the floor to reach instrument location.

You may not know that *two* EYE-HYEs can be connected to the same drum, if two control stations are desirable. On some ocean going ships, for instance, one EYE-HYE serves the boiler room, another provides an extra check in engine room or control gallery.

If you have special problems of EYE-HYE location which do not seem to be explained here or in Form 425, our engineers will gladly help you solve them.

BOILER SAFETY DEVICES

THE RELIANCE GAUGE COLUMN CO.
Cleveland, Ohio

Conservation of boilers

Don't have to say:
"ANOTHER BOILER DOWN FOR REPAIRS"
Time was when you would have taken a situation like this as an inevitable matter of course. You would have had the reserve capacity to make all the steam you needed. You had, or could easily get, replacement parts. We weren't at war then. Steel wasn't on the critical list. Today, a tube failure is often a near calamity. A boiler down may mean a serious delay in war production. You can't afford to let it happen. It won't if your plant has "preventive care."

is a wartime MUST!

Clearly . . . You can't have your cake and eat it. Materials shortage makes replacement a headache.

NOTHING could be plainer. With everything made from steel next to impossible to get, you're faced right now with a repair parts problem. There's only one way out—you've got to make the most of everything you have. You've got to keep it working. It's become a wartime "must."

> . . . if Hall Boiler Plant Service had been expressly created to help you in this situation it couldn't have been better designed for the task.

For Hall Service is definitely designed to give "preventive care." It works on the principle that when the right things are done at the right time, boiler troubles will be caught before they get a start. Many repairs won't be needed. Scale, corrosion, carryover and embrittlement, the ever-present enemies of steam output, will be kept under perpetual control.

The origin of this service dates back to World War I. Old-timers in the power field don't need to be reminded of the appalling situation they faced when real "preventive remedies" for boiler ills were practically unknown. It was Hall research, born of this need, in 1922, which has since paid rich dividends to American industries. Not a high-pressure boiler in use today fails to benefit from it, not a low-pressure boiler to which its benefits are not equally available.

No ordinary routine comprises a Hall Field Engineer's work. In close cooperation with the power plant operator every possible avenue for trouble from water is watched. A system is set up which, if properly followed, reduces boiler outages therefrom to a positive minimum. Continuous peak steam production is a practical certainty.

If you have been, or may soon be facing the inevitable penalty of pushing your equipment to the limit, this is the time to find out what Hall Service is accomplishing in hundreds of America's war industries. Write, phone or wire.

HALL LABORATORIES, INC., HAGAN BLDG., PITTSBURGH, PA.

HALL SERVICE IN A NUTSHELL

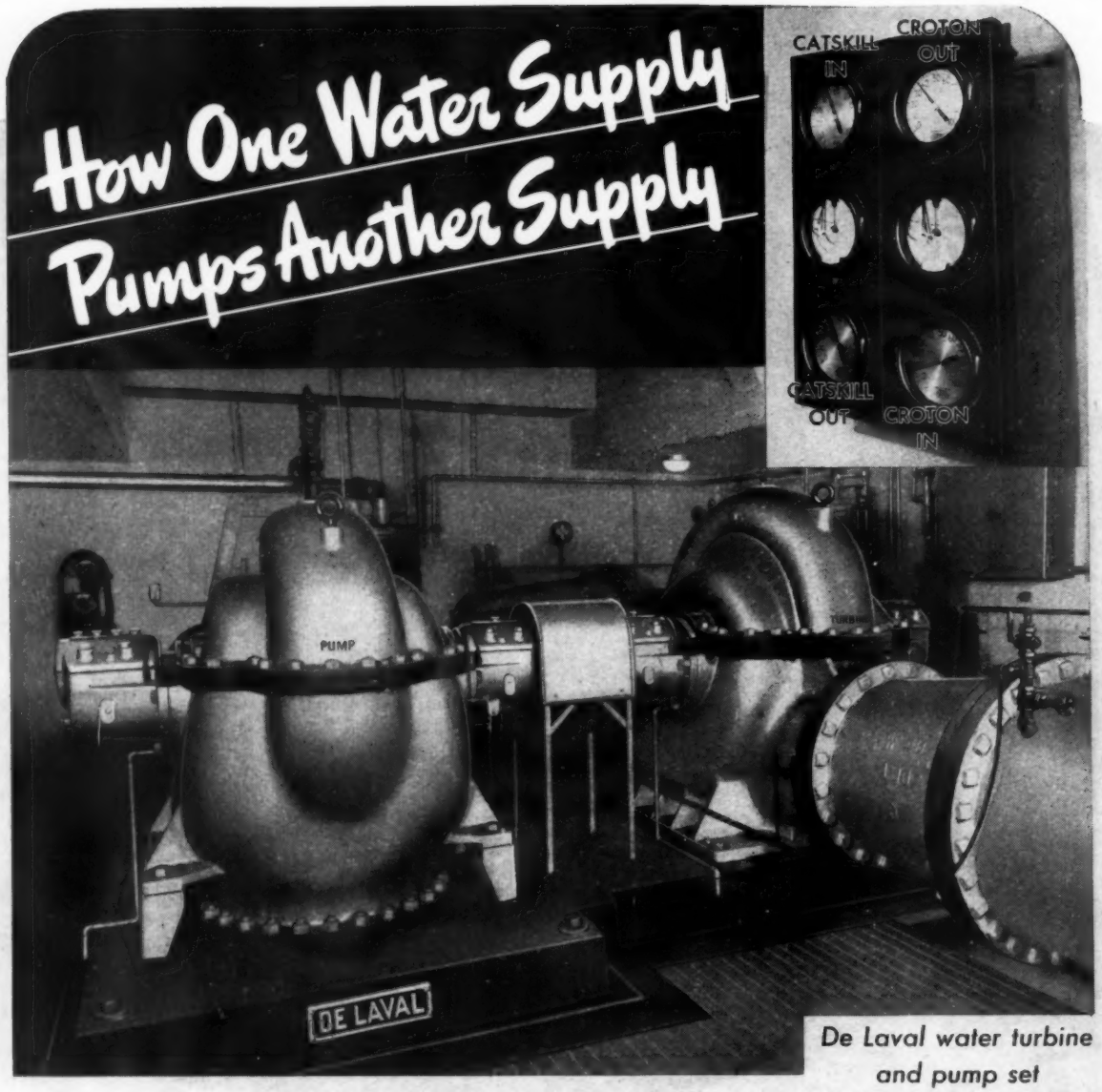
At your immediate disposal are placed the technical knowledge and facilities of the pioneering leaders in scientific boiler water conditioning.

In addition, with your full cooperation, Hall Service:

1. Minimizes boiler outages caused by water.
2. Helps maintain highest efficiency.
3. Establishes non-embrittling water.
4. Minimizes carryover.
5. Prevents corrosion in boilers and associated equipment.
6. Prevents deposition in water lines and cooling systems.

HALL SYSTEM
of Boiler Water Conditioning

How One Water Supply Pumps Another Supply



De Laval water turbine and pump set

The De Laval Water Turbine and Centrifugal Pump set here shown is located in a room beneath one corner of the Public Library, 40th St. and Fifth Avenue, New York City. At full capacity the water turbine, receiving 20,800 g. p. m. of Catskill water under 210 ft. head and discharging to its distribution system against 120 ft. head, drives a pump operating at 560 r. p. m., which delivers 21,000 g. p. m. of Croton water to its distribution system against 100 ft. head. The positive head at the suction nozzle is 35 ft. and 392 hp. is delivered by the water turbine.

The speed of the unit is automatically regulated by a hydraulically operated throttle valve in the turbine discharge line, actuated by the pressure therein. No particular attention is necessary other than occasional inspection of the lubricating system.

De Laval engineers will gladly help in solving your pumping problems.

4107

DE LAVAL *Steam Turbine Co.*
TRENTON, N. J.

MANUFACTURERS OF TURBINES . . STEAM, HYDRAULIC; PUMPS . . CENTRIFUGAL, CLOGLESS, ROTARY DISPLACEMENT, MOTOR-MOUNTED, MIXED-FLOW, PROPELLER; PRIMING SYSTEMS; CENTRIFUGAL BLOWERS and COMPRESSORS; GEARS . . WORM, HELICAL and FLEXIBLE COUPLINGS

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AUGUST 1943

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Cover photo courtesy General Electric Co.

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heat balance—

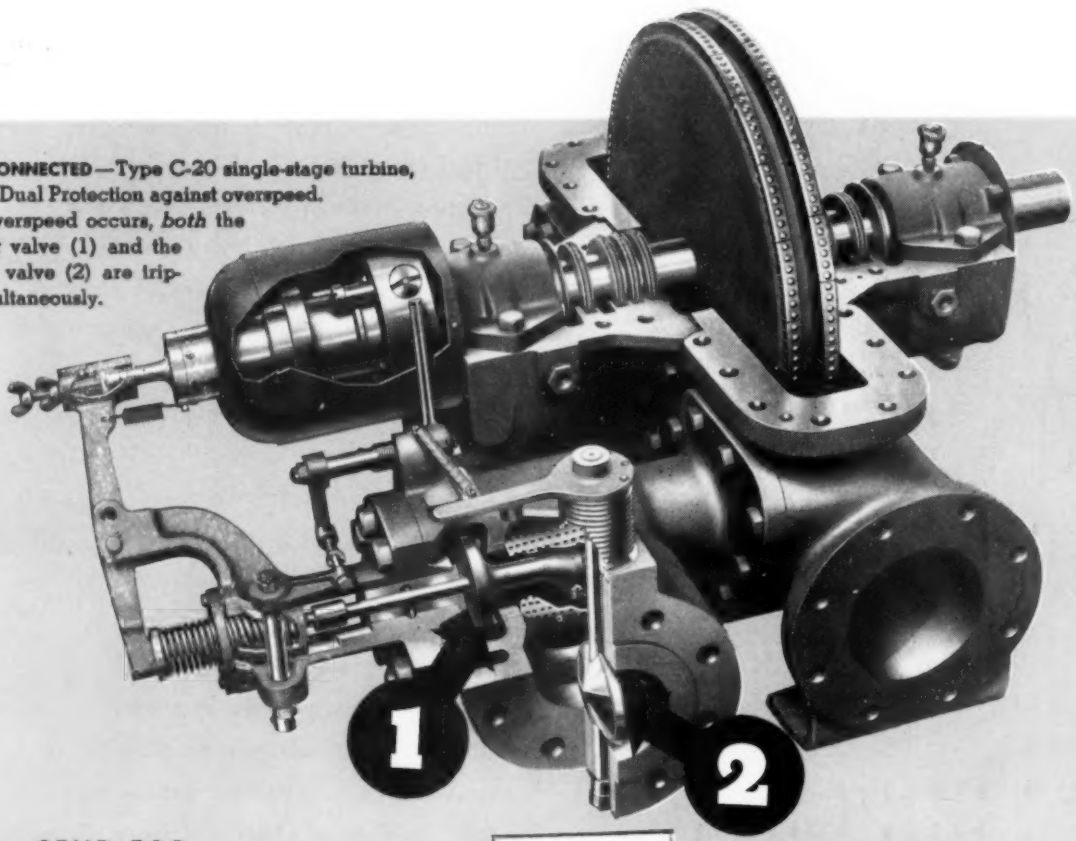
FROM 100 TO 5000 HORSEPOWER—Type M multi-stage turbines, 1000 to 5500 rpm, for inlet pressures through 650 lb. ga., total temperatures through 750° F., and exhaust pressure through 200 lb. ga.

CONDENSING OR NON-CONDENSING—Heat balance problems are simplified, since any of these Westinghouse turbines can be built to operate condensing or non-condensing.

SAFE—Dangerous overspeeding is prevented. Types C and CH turbines have Dual Protection, which actuates *both* the governor valve and the butterfly valve at the *same time* in event of overspeed. Trip lever is sparkless, with a Micarta insert.

ECONOMICAL—Blading proportions are the result of extensive research. Blade pitch is uniform. Blade shrouding is made conical to approximate the steam expansion characteristic. Nozzle dimensions are accurate. All this adds up to maximum steam economy.

RELIABLE—Fully protected against corrosion and erosion. Blades and shrouds are chrome-alloy. There is no soft packing on the inlet valve stem—hence, no sticking.



DIRECT-CONNECTED—Type C-20 single-stage turbine, showing Dual Protection against overspeed. When overspeed occurs, *both* the governor valve (1) and the butterfly valve (2) are tripped simultaneously.

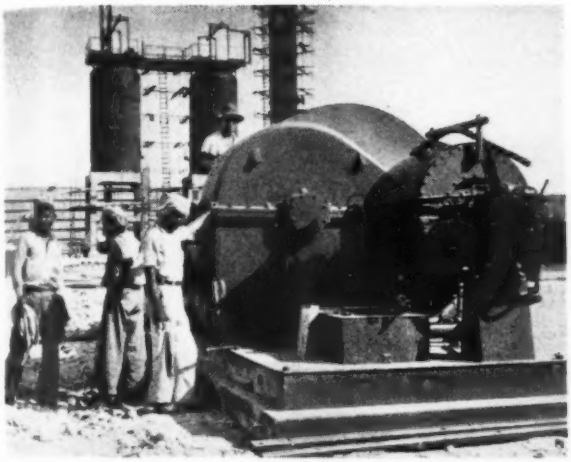
SEND FOR THE BOOK YOU WANT

Booklet 2230 on Type C single-stage turbines. Folder 8574 on Type CH heavy-duty turbines. Booklet 2278 on reduction gears.

WESTINGHOUSE STEAM EQUIPMENT FOR REFINERIES INCLUDES:

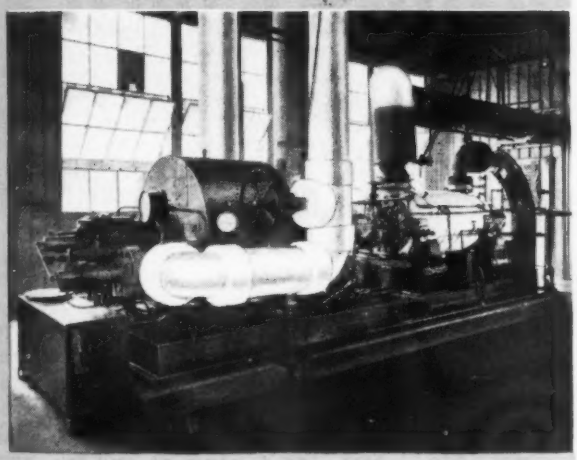
Turbine-generators. Mechanical-drive turbines. Reduction gears. Condensers. Feed water heaters. Air ejectors for condensers and process. Vacuum-cooling equipment.

FOR BUTADIENE, STYRENE AND HIGH OCTANE GAS PLANTS

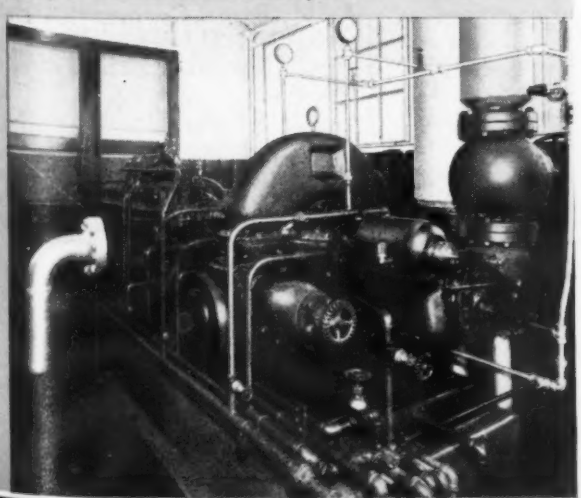


GEARED—Type M multi-stage turbine, with close-coupled reduction gear, driving a pump in an Iraq refinery. One of seventeen Westinghouse turbines installed.

MULTI-STAGE — Type M turbine, with hydraulic orifice governor, driving a hot oil pump. Nineteen Westinghouse turbines are installed in this Indiana refinery.



SINGLE-STAGE — Type C-25 turbine driving a charging pump in a southwestern refinery.



WESTINGHOUSE HAS THE RIGHT TURBINES FOR STEAM DRIVE ECONOMY IN ANY APPLICATION

ECONOMY AND EFFICIENCY of power in any refinery depend to a large extent on proper heat balance. That is why engineers and contractors who plan and build refineries insist on selecting *co-ordinated* steam turbine drives. These drives must deliver the required horsepower at the right rpm for pumps and other driven equipment, using available high pressure steam, and exhausting at reduced pressure to supply the demands of process and heating. And that is why more and more refineries are coming to Steam Headquarters for their turbines. Whatever the variation in size or process, Westinghouse has a complete line of turbines and related steam equipment that will help solve refinery heat balance problems.

FLEXIBILITY OF APPLICATION is possible, because the Westinghouse line includes: (1) single-stage turbines for average efficiencies, and multi-stage turbines for greater steam economy; (2) condensing or non-condensing units; (3) suitable governors to provide any required quality of speed regulation; (4) reduction gears to make possible efficient turbine speeds with the right rpm for driven equipment; and (5) low-level jet, barometric or surface condensers with co-ordinated auxiliaries.

FROM 5 TO 1500 HORSEPOWER—Standard Type C turbines 1000 to 5000 rpm, with inlet pressures through 600 lb. ga., total temperature through 750° F., and back pressures through 50 lb. ga.

FROM 50 TO 2000 HORSEPOWER—Type CH heavy-duty, single-stage turbines, 1000 to 4500 rpm, with inlet pressures through 1500 lb. ga., total temperature through 950° F., and exhaust pressure through 300 lb. ga.

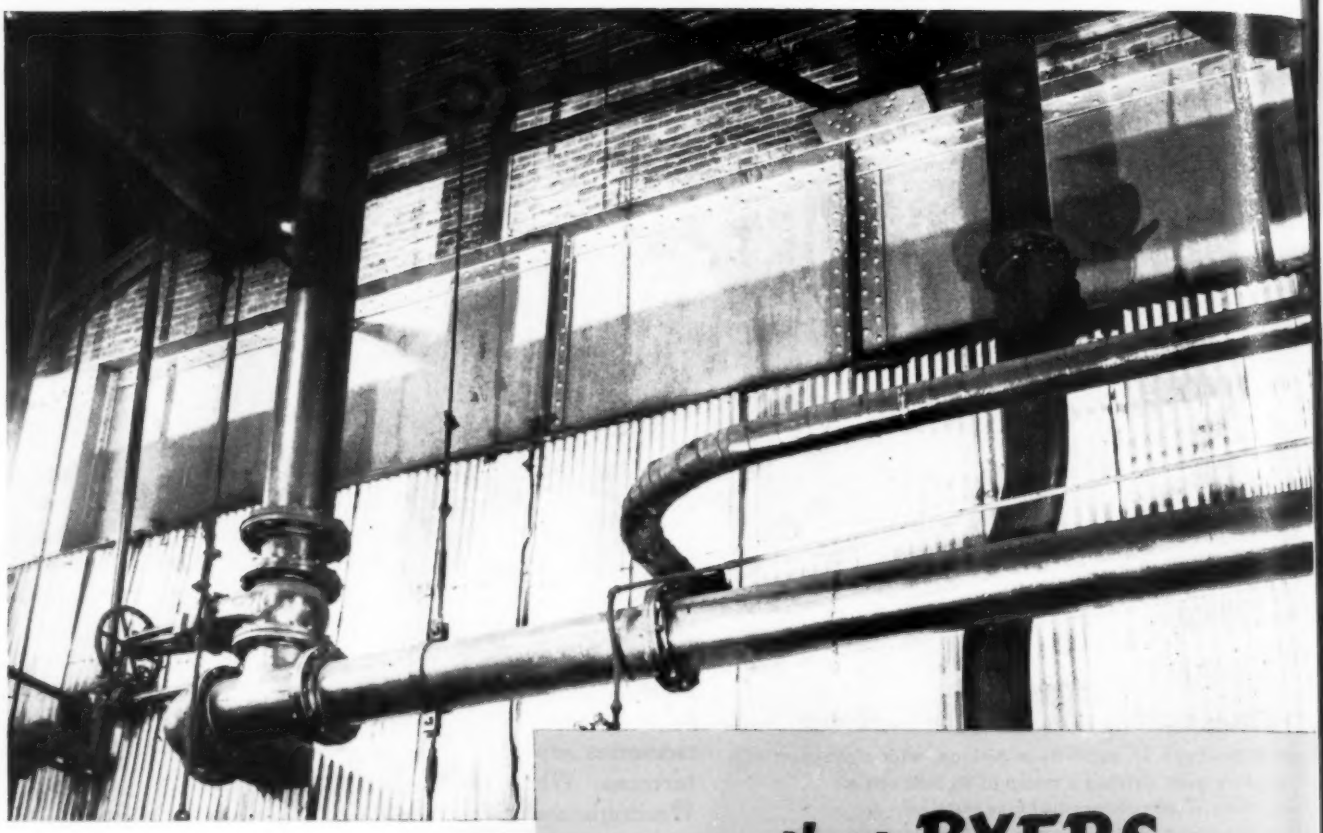
J-50433

Westinghouse

PLANTS IN 25 CITIES ... OFFICES EVERYWHERE

WESTINGHOUSE

STEAM HEADQUARTERS



All plants have one maintenance problem in common ...

that BYERS WROUGHT IRON helps to solve

Every maintenance man has his own individual problems, but there's one that's universal—maintaining steam return lines, which are always exposed to severe corrosion.

The condensate itself attempts to dissolve any material it touches. Carbon dioxide, released in the boiler and carried over with the steam, forms an extremely active acid . . . and difficulties from this source are often increased through certain feed-water treatments. Finally, oxygen is frequently present in harmful amounts . . . especially in vacuum systems. These add up, generally, to vicious attack on the steam return lines, and troubles for the engineer.

Ordinarily it is undesirable to make "blanket" recommendations without careful preliminary study of the local conditions. But in the case of steam return lines, black wrought iron has been used in so many applications with such uniform success that sound engineering permits a flat "OK."

Any comprehensive listing of wrought iron service records is out of the question . . . but if you are currently repairing any steam return lines, or contemplating any new construction, our Engineering Service Department will be glad to give you case histories. Ask, also, for a copy of our technical bulletin, "Wrought Iron for Piping Systems," which contains some helpful information on the general subject of corrosion, and how to combat it.

A. M. Byers Company. Established 1864. Offices in Pittsburgh, Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

Corrosion costs you more than Wrought Iron

BYERS
GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE ALLOY STEELS OPEN HEARTH ALLOY STEELS
CARBON STEEL TUBULAR PRODUCTS

Management
—Heart of America's Industrial Progress

In Peace and War, Management Men and Methods Steer Production on a Steady Upward Course

WHEN the Allied armada of 2,000 ships, protected by a vast umbrella of planes, struck the coast of Sicily, Axis leaders once more had reason to wonder how "that decadent, pleasure-loving America" had swung from the manufacture of automobiles, refrigerators and costume jewelry to equipments of war, and had out-produced such mighty plants as the Krupp, the Fiat and the Skoda works — and had done it so quickly.

America at war is in the lead just as it has led a world at peace. Super-performing planes are taking to the air at the present rate of nearly 100,000 per year. Ships, to carry the war to our enemies, slide down the ways at the rate of two a day. Tanks, trucks, guns, ammunition are pouring out of our "peace" plants in far greater volume than the entire Axis effort can possibly equal. War expenditures in 1943 alone will reach the staggering figure of approximately $83,000,000,000 — an amount equal to our entire national income for 1929. Added to this is the rock-bottom output of essential civilian goods — a very considerable item.

This unprecedented production is taking place while some 9,000,000 men and women, those physically best equipped, have been called to the armed forces. Many of them were taken from industry, and their loss could be repaired only by more efficient equipment and more effective methods.

Rigorous training programs had to be superimposed upon many other abnormal problems facing industry in its high-speed conversion from stoves to boats; from printing machines to guns; from automobiles to airplane engines; from fishing tackle to bomb sights.

This phenomenal task was further complicated by the need for rapid expansion. A modest machine tool industry had to be expanded to handle a volume many times its normal capacity. Steel production had to be increased by 20%, and that of aluminum and magnesium multiplied over and over. From almost nil, the demand for high octane gasoline soared to unbelievable quantities. The creation of synthetic rubber and electronic industries was necessary almost overnight.

Who deserves credit for these accomplishments? All industry! The engineers, chemists, designers, skilled workers, common laborers. But over and above all it belongs to *management*.

In industry it is mandatory to have a directive force to coordinate the efforts of men in the use of materials and the application of power toward the production of goods and services. The application of this directive force is the function of management, and only because we had today's kind of management were we able to transform ourselves, almost overnight, from a peace-loving nation to the world's greatest producer of implements of war. As a nation, we had been preparing for a long time to play our part in world affairs. This preparation, certainly not planned for today's objectives but none the less effective, began some four decades ago.

With the advent of the twentieth century, the character of industry in the United States, and, therefore, the character of American living, began to change. Scientific management was born. Frederick W. Taylor brought into focus and showed how to use effectively those processes and procedures upon which our present-day mass production is based. He was followed by Harrington Emerson, who made the industrial world acquainted with efficiency in manufacture and the remarkable progress to be gained therefrom in the field of production, with its consequent price reductions and wider distribution of industry's products. There followed, in industry, an alert management, a capable management, a management with vision. Without it, the work of Taylor and Emerson would have gone for naught.

It is because of this early work of management — and the extraordinary developments it produced — that the country as a whole, and particularly those employed in industry, were not over-awed by the seemingly impossible job of quick conversion to all-out war production. But let us look back four decades and examine some of those preparatory accomplishments which have proven so vital to the progress and welfare of the nation.

From 1900 to 1939 (the last pre-war year), total employment of all kinds increased 52 per cent; in the manufacturing industries alone the increase was 84 per cent. *The nation became definitely industrial.*

In 1900 the average wage earner was able to spend only 20.2 per cent of his income for things other than necessities; in 1930 his buying power for non-essentials had increased to 34.8 per cent. *The average man acquired confidence in what industry could do.*

In 1900 the average work week was 56 hours; in 1930 it was 48 hours. *The burden of production was being transferred from man to machine.*

In 1939 the United States possessed 30 per cent of the world's railroads, 72 per cent of its automobiles, 49 per cent of its telephones. *The nation's production equipment had grown to formidable proportions.*

In 1939 nearly half of the families in the United States owned their own homes, 64 million individuals carried life insurance policies and 45 million had savings accounts. National income had increased 300 per cent from 1900 and during the same period the proportion of national income paid out in salaries and wages increased from 58 to 70 per cent. And in less than this period (1914–1939) the purchasing power of the wage rate increased by 60 per cent. *There had been evolved the kind of living for which men will work — and fight.*

Since 1900, factories increased their output of goods from $11,000,000,000 to $60,000,000,000 in 1939. This increase of nearly 450 per cent was accomplished while the country's population rose only 60 per cent. In this same span of years, technological developments and improvements in methods had

increased the value added by manufacture per wage earner by 200 per cent, and the horsepower per factory worker had been multiplied by 2½. *The nation's production plant was ready to assume its gigantic wartime job.*

During this period of industrial and national evolution, management itself had changed. Prior to the advent of scientific management, our goods and services were the product of several kinds of directive activities, varying from the strictly paternalistic to the ruthless. There was little conception of the responsibility that industry now broadly acknowledges — the responsibility of trusteeship in the interest of stockholders, employees and the public — specifically; in the interest of our national economy — generally. Acceptance of this stewardship is acceptance, also, of the belief that, in the long run, no industry, and no unit of industry, that does not serve society can live.

Have the actions of management caused the times to change? Or has an alert management been successful only because it has changed with the times? Certainly, the industrial concern of 1900 would not thrive under the conditions of today. Just as certainly the new things that industry has in store for a waiting postwar world will have a far-reaching effect upon the times.

Management today seldom owns the factory or the business it manages. It is hired to perform the coordinating, directive functions. It is free to change — of itself, or with the times. Management therefore exercises its power through leadership in executing ideas . . . not through ownership.

This is the fourteenth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

Good management can be sustained only in an environment sympathetic to its aims. It has an undeniable obligation to society, because it must be a compatible part of the social structure or be rejected by that structure as a whole.

An environment sympathetic to its aims means, also, that industry, in the very serious reconstruction period ahead, will not be at full effectiveness if it is subjected to attacks by government no matter what the underlying reasons may be — over-zealous devotion to a cause, lack of understanding or just plain politics. It was to industry — to industrial management — that the government turned when our existence as a free nation was threatened; it is to industrial management that government must turn in order to win the peace.

This statement is made in the sincere conviction that what has made America strong is industry's ability to produce consistently more and more goods and services for more and more people. It is only by actually creating them that we built up our stockpiles of the necessities of life. And it is only by creating them that we can have more of those things that make life worth while. These become available to more people as industry succeeds in getting greater output of goods and services for a given input of human energy, materials and power.

And what of the physical jobs ahead? In this country alone, there will be an immense demand upon industry to supply the things people have been unable to purchase during the war. Today the nation is wearing out not only its automobiles, refrigerators, vacuum cleaners and radios, but its very houses, its roads, railroads, and airline equipment. It is saving its money while whetting its appetite. Truly, the calls the American people will make upon industry in the postwar period will be many and insistent.

This demand can be viewed in another light. Economists say there will be 56,000,000 persons seeking gainful employment after the war. The Committee for Economic Development has estimated that $140,000,000,000 worth of goods and services will be required each year for those people. Compare that with our actual output of $97,000,000,000 worth of goods and services in 1940 when gainful employment was 46,000,000.

These future jobs will be done if industry's management is not too much hampered by government management. Management in industry performs its function in the field of doing things. Management in government performs its function in the field of *regulating* things. The best cooperation of the two kinds of management will be necessary in the postwar period. Certainly, too much of the regulatory kind will interfere seriously with the kind that does things.

Industrial management must improve, too. If it is too selfish, if it does not recognize definitely the trusteeship inherent in its job, if it does not understand and live up to its social responsibilities, then it will be risking all for which we are fighting. The following suggestions are made to indicate the direction that management's self-improvement can take.

Evolution in management has been too slow in some respects. Management in industry has been too prone to see the advantages in technological development while being blind to its evils. Looking at industry and social progress as a whole, there can be no doubt as to the value of technological improvement. It creates jobs. It elevates the standard of living. But that economic fact is of no satisfaction to the individual who loses his job because a new machine or a new method required one less man. By and large, this is an evil that management can do something about.

Management has been too careless of its opportunities with regard to labor. On that account the pendulum of social readjustment has swung too far. Labor has been given extensive privilege without corresponding responsibility.

Industrial management has been too slow to abandon its policy of letting the buyer beware. As a result of this, industry today is over-regulated.

Management has been too slow in recognizing its responsibility to promote the economic philosophy that a society cannot have for consumption what it does not produce. A companion educational item too long neglected is management's obligation in the field of public relations.

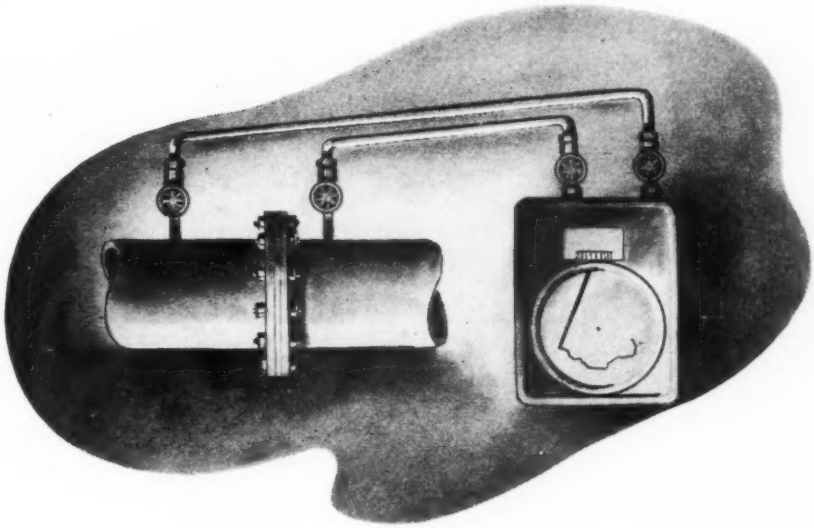
In these years since 1900, industrial management has been growing. Perhaps many of its experiences have been but growing pains. Management has learned, among other things, the absolutely vital need for capital at the right time and in the right amount. It has learned to use some of its earnings as "seed-money" in the introduction of new products and the use of new processes. It has learned to invest more and more in research. It has learned of the interdependence of industry and agriculture. And it has learned much about the eternal triangle of industry, labor and government.

With such a history and such experiences behind it, I have every faith that management is going ahead to even more glorious accomplishments in the winning of the war, and I believe that its peacetime accomplishments to come are beyond the prediction of any of us — even management itself.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

ESTABLISHED IN 1882 POWER PHILIP W SWAIN, EDITOR



Practical Guide to Accurate Metering

ON PAGE 87 the reader will find an eight-page manual on flowmeters—how to install them correctly and keep them accurate. Working closely with the editors, the author has achieved an intensely practical presentation. With no waste words he tells how to prevent and cure meter ills to the end that the flow charts of America's central stations, institutions and industrial plants may do a 100% job for today's War and tomorrow's Peace.

In the switch from the peacetime pursuit of dollar economy to wartime concentration on production, flowmeters have again proved their versatility. When good service at minimum cost was the prime job, they did it so well they paid out in a year or two, often less. And when all-out war production called for more kilowatts, more steam, water and compressed air, yet restricted the purchase of new units to make these services, meters again came to the rescue. They helped the power engineer stretch the capacity of his existing units to keep the wheels of industry turning.

The battle of the meters in the power field was fought and won long ago. Today their advantages in war and peace are taken for granted. Too much so, in fact, so let's remind ourselves again of what they can do for us if rightly selected, applied, maintained and used:

Meters keep score on the efficiency of power units. Without this score sheet the engineer can't play the game right.

Meters on service generating equipment save fuel dollars and electrical dollars.

Meters also increase effective capacity by cutting waste in generation and application. This saves investment dollars.

In two- and three-shift plant operation, meter records protect faithful operators from unfair criticism, and put the finger on bluffers and loafers.

When equipment performance starts to limp because of accumulating scale, soot, leaks or dirt, meters detect the decline long before the trained operator would notice it. Thus many dollars are saved by early correction.

If the real trouble is equipment decrepitude, that fact too is revealed by meters, which thereby become a safe guide to modernization.

Departmental distribution meters on power services permit finding the true cost of manufactured products. At the same time they penalize wasteful consumption and promote thrift.

All these benefits meters bring to the plant, the owner and the engineer if the instruments are rightly selected, installed and maintained to give correct readings. Pages 87 to 94 tell how.

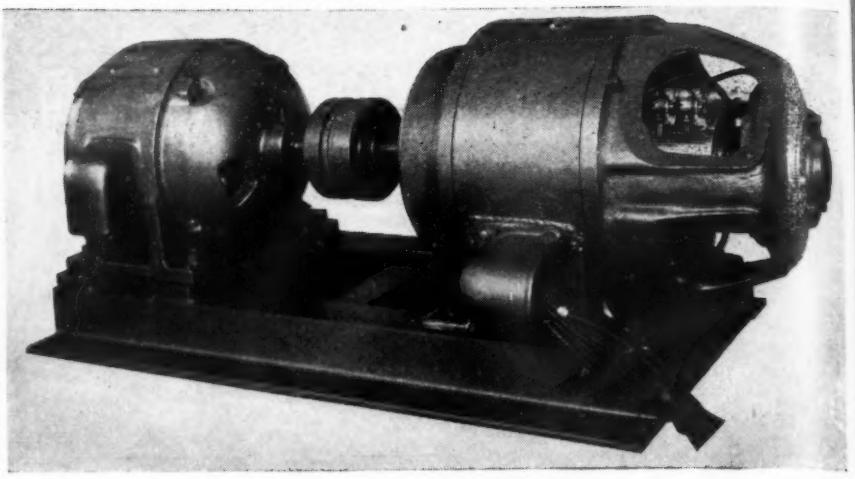


Fig. 1—(Right) This amplidyne motor-generator set consisting of a 5-hp 1750-rpm squirrel-cage induction motor and a 3-kw 250-v amplidyne generator

Fig. 2—(Opposite page) Hot-strip steel mill uses amplidyne exciter for constant-tension automatic control of strip as it is wound in a roll by the reel

The AMPLIDYNE

What It Does for Power Control

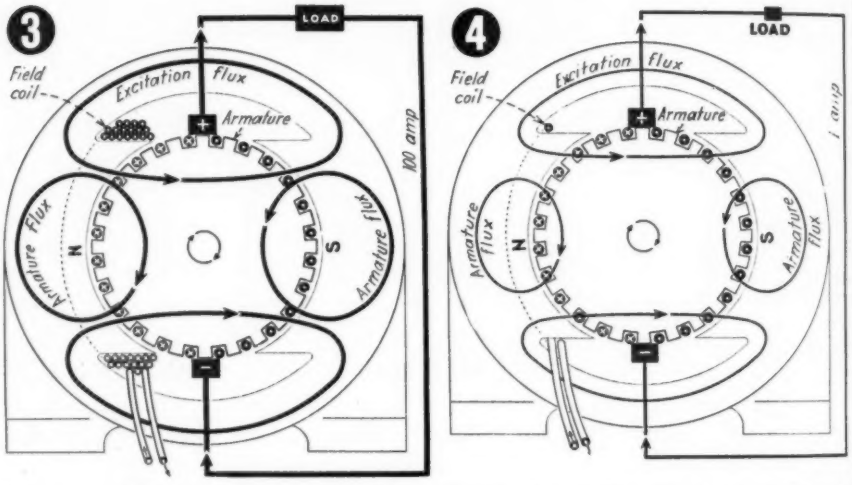


Fig. 3 to 6—Steps explaining how amplidyne works. Fig. 3—Diagram of a conventional-design dc generator. Fig. 4—Same as Fig. 3, but with field-excitation power reduced

► AN AMPLIDYNE (amplifying dynamo) is a separately excited dc generator, usually driven by a squirrel-cage motor, as in Fig. 1, and may be used as an amplifier, a regulator or an exciter. Everything else being equal, the amplidyne requires only about 0.01 of the field excitation watts and responds 50 times faster than a comparable dc generator of conventional design. The latter requires about 2.5 sec to reach 90% of full-load volts, while the amplidyne needs only about 0.05 sec. Fig. 3 to 6 explain the operation of this machine.

Fig. 3 shows schematically a conventional 2-pole dc generator of, say, 10-kw capacity driven at constant speed. For simplicity, the brushes are shown resting on the armature instead of on a commutator. Also, a single field coil only is shown, and this is on the north pole. Circles with a dot in them indicate conductors carrying current toward the reader; circles with a cross, indicate current flowing away from the reader.

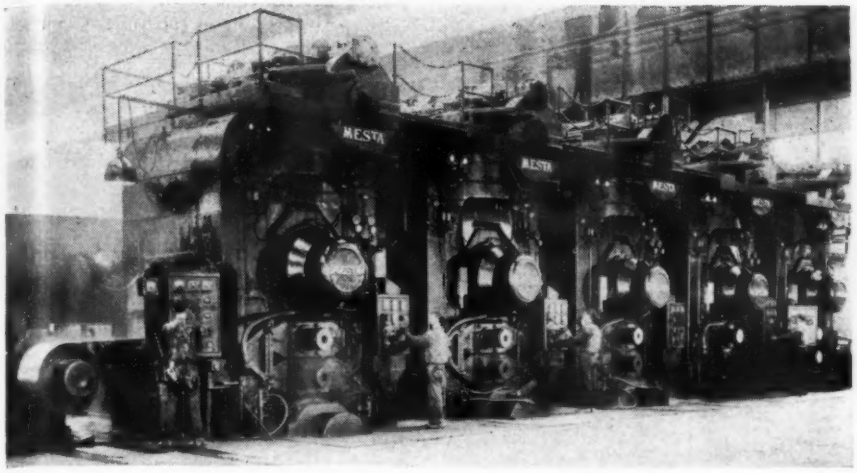
In this 10-kw machine about 100 watts supplied to the field coils produce the magnetic flux in the field poles. This flux may be assumed to be sufficient for the generator to produce 100 v at its terminals, which circulate full-load current, 100 amp through the load having a resistance of one ohm.

When the load current of 100 amp flows through the conductors of the rotating armature, it creates a stationary magnetic field in a direction indicated by the heavy lines in Fig. 3, marked *armature flux*. This flux is produced because the armature conductors to the left of the brushes carry current away from and those to the right of the brushes conduct current toward the reader. Current in these conductors has the same effect as though they were on a stationary solenoid, with its longitudinal axis parallel to the vertical axis through the brushes. The armature flux has about the same magnitude as the *excitation flux*, Fig. 3, but is not doing any useful work. The amplidyne puts this flux to work.

With a smaller field coil and excitation power reduced from 100 to 1 watt, the generator, Fig. 3, is represented in Fig. 4. The reduced excitation power creates only 1% of the original magnetic flux. Voltage at the brushes decreases to 1 v and the load current to 1 amp, which produces only 1% of the former armature flux. In this setup excitation power has been reduced to a value where it can be supplied and handled by precise-control devices.

Assuming the armature-winding resistance to be 0.01 ohm, then a short-circuit across the brushes, as in Fig. 5, will restore the armature current and flux to the values of Fig. 3. In Fig. 5, the control excitation power and magnetic flux are still extremely small, but they control full-load armature current and flux.

To put the armature back to work delivering full kilowatt output, another set of brushes is added in the center of each armature-flux loop, just as the conventional brushes are placed at the center of the field-excitation-flux loop. Since the armature flux in Fig. 5 is assumed to equal the excitation flux in Fig. 3, then 100 v is generated between the brushes in Fig. 5. If we connect



ro and How It Does It

By FREMONT FELIX
Industrial Engineering Dept
General Electric Co

Construction, operation and applications of the amplidyne, a separately excited dc generator requiring only 0.01 of the field watts and responding to field excitation changes 50 times faster than a conventional generator of comparable size and speed

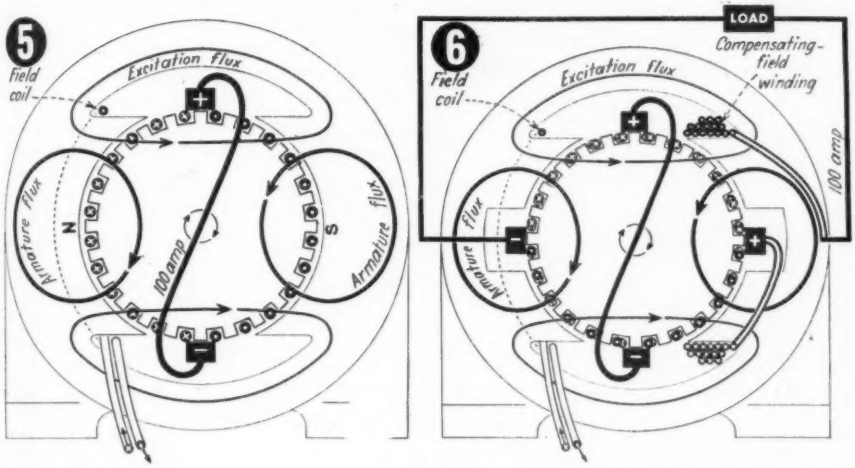


Fig. 5—Same as Fig. 4, but with armature short circuited to excite the field poles
Fig. 6—Amplidyne exciter, same as Fig. 5, but with set of load-current brushes added

the new brushes to a load of 1 ohm resistance, 100 amp will flow through it, as indicated in Fig. 6.

The load current in the armature conductors, in Fig. 6, adds to the short-circuit current in part of the winding and subtracts from it in the remainder. This is indicated by the combination of dots and crosses in the armature slots. A compensating winding has been added to the south field pole and connected in series with the load. Current flow in the compensating winding conductors is opposite to load-current flow in the armature conductors. This is done so that the compensating winding will neutralize the magnetizing effects of the load current in the armature conductors and make it possible for the output of 10,000 watts to be controlled by only 1 watt of field excitation. This is the amplidyne.

Assume that the excitation current is suddenly doubled by doubling the voltage. This increases the excitation watts from 1 to $2 \times 2 = 4$. This instantly doubles the short-circuit current, produces double output voltage (200 v) and forces double current (200 amp) through the load. This gives an output of $200 \times 200 = 40{,}000$ watts, or 40 kw. Thus, merely by increasing the control input 3 watts, load output is increased from 10 to 40 kw.

To obtain changes in output in response to minute changes of excitation with conventional dc generators would require two machines (exciters): (1) a small pilot exciter, which has its equivalent in the control field and short-circuited brushes of the amplidyne, (2) a larger machine, which would have its field coils excited by the pilot unit, and which is represented in the amplidyne by the short-circuited current in its armature and the output load current. A small change in the control current in the field coils of the pilot exciter would be considerably amplified in the main exciter but with accumulated delay of response.

We have these two machines combined in the amplidyne in a way that gives very high amplification of the control power and at a very high rate of response to changes in this power. In the amplidyne, speed of response is accelerated because the output flux is produced by the armature windings so that even the flux that leaks through the air produces useful voltage. As a result, it will deliver a 10,000:1 amplification in 0.1 of a second.

When incorporated in a system, the amplidyne acts like a very fast sensitive regulator to maintain constant electrical power, current, voltage, speed, tension, etc. by promptly correcting any departure from the desired condition. It translates small signals into fast and accurate motion and positioning, protects equipment by limiting loads, speeds up acceleration and retardation of high-inertia machines, and continually matches speed and speed changes.

The control-field winding of the amplidyne takes so little power and requires so little space that instead of using just one field winding as many as four may be used. One of these provides a definite standard of reference, the others tell the amplidyne how the different objectives are being met. The

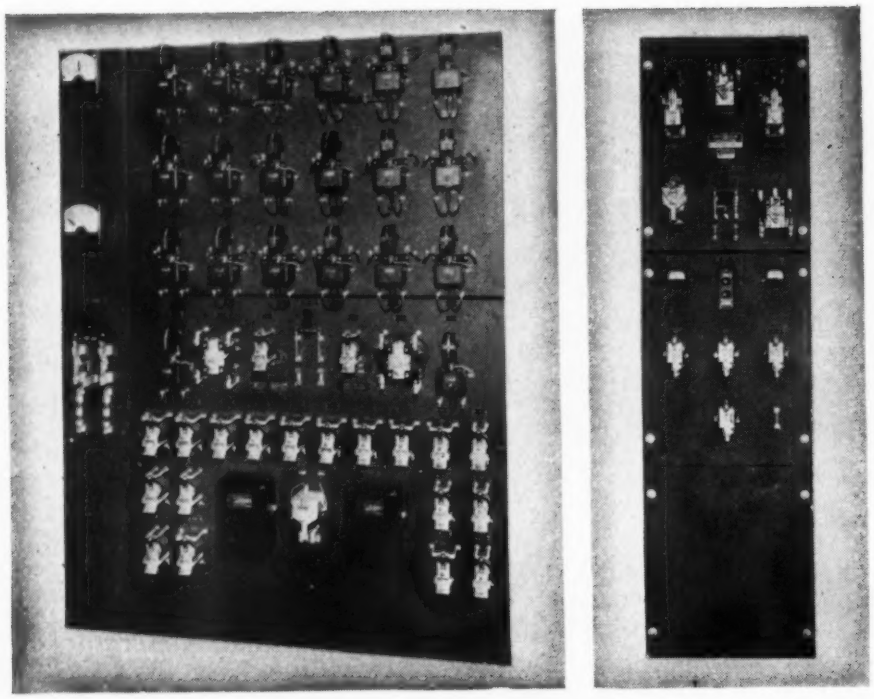


Fig. 7—(Left) Panel for conventional variable-voltage control for a dc motor driving a mine hoist. Fig. 8—(Right) Variable-voltage control panel for a drive which is comparable to that in Fig. 7, but which uses an amplidyne

amplidyne responds to the resultant action of all the control-field windings and amplifies this action in the same manner as when it is produced by a single field winding.

The reference, field winding, is generally energized from a constant-voltage source, as in Fig. 10, and tends to make the amplidyne deliver maximum voltage and output. The other control-field winding, or windings, opposes the reference field and leaves a net excitation of the right amount to give the desired result. If operating conditions, such as generator voltage, current or speed, suddenly become too high, current in the corresponding amplidyne-field winding increases and the resultant excitation decreases or even reverses. This acts as a powerful corrective to restore operating conditions to normal.

Control-Field Windings

Current in each control-field winding can be easily adjusted by a small resistor or other means. Since the current taken by these windings is so small, their action may be blocked by small rectifiers so long as a certain operating condition or limit is not reached. Multiple control-field windings in the amplidyne greatly reduce the number and size of control devices required to obtain a certain performance.

Fig. 7 and 8 show the simplification possible in control equipment by the use of the amplidyne. Fig. 7 is the panel for a conventional variable-voltage control for a dc-motor-driven mine hoist; Fig. 8 is a similar control, but with an amplidyne as part of the control system. The latter has only nine contactors and relays compared to 43 for the conventional-design method.

Because of the small input to the control-field winding of the amplidyne, this winding can receive the output of a vacuum tube and amplify it directly to control a large machine. Fig. 9 shows diagrammatically how this can be done. Here a two-stage electronic amplifier gives a 10,000:1 amplification. Output of the electronic tubes goes to the control-field winding of the amplidyne and is amplified 10,000 times to 10 kw to excite the field coils of a 2500-kw generator. Here we start with a signal power input of 0.0001 watt to a vacuum tube and end with a 2500-kw output; an over-all amplification of 25 billion.

As an example of the use of electronic tubes in combination with the amplidyne, Fig. 10 shows how a photoelectric-tube control shifts a large reel with its roll of paper or sheet steel to

(*Continued on page* 136)

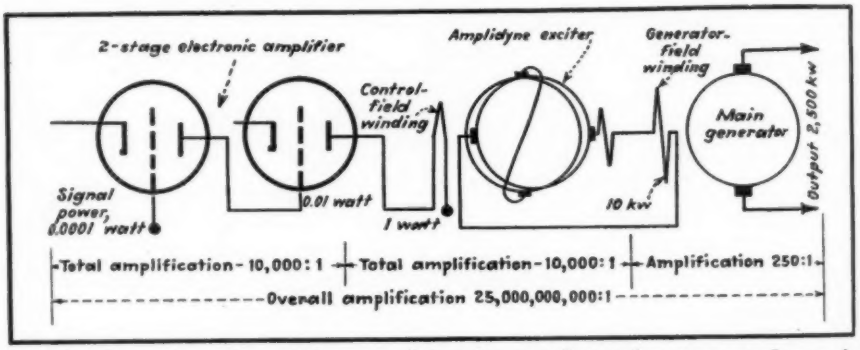


Fig. 9—Electronic and amplidyne amplifiers harnessed together to control a main generator to obtain a total signal-control amplification of 25 billion

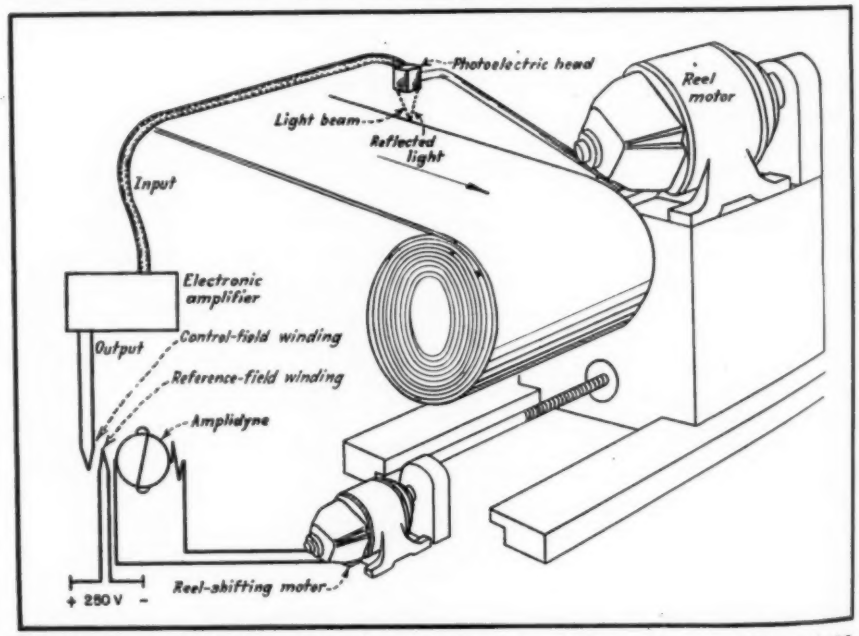


Fig. 10—How a light beam through an electronic amplifier and an amplidyne holds edge of paper or sheet-steel within 0.01 in. of the correct location

New Coal Chute that Eliminates Stoker-Hopper Segregation Is Easy to Make

Equally suitable for new chutes and for conversion of existing flat spouts, this non-segregating design requires minimum headroom and fits widely varying installation conditions

By PHILIP B RICHARDSON, *Secretary, Richardson Scale Co*
and MAX R BOYE, *Chief Engr of Power Plants, Wyman-Gordon Co*

▶ COMBUSTION PROBLEMS and lack of capacity in many stoker-fired plants trace back to segregation in the hopper. Coal flowing through an ordinary spout or chute tends to separate so that fine particles concentrate in the middle of the hopper and coarse particles at the ends. This condition continues into the fuel bed, making it impossible to obtain desired uniform combustion conditions from one side of the fire to the other.

Of the many solutions offered for this problem, some have been good, but none has been universally acceptable and all have involved a substantially greater investment than a simple chute or spout. The traveling larry does a good distribution job across a stoker hopper if the operator is intelligent and conscientious, but the human element is not too dependable. The manual or mechanical swinging spout also does a good job but, like the larry, requires attention and often fails to meet modern standards of boiler-room cleanliness. Flat spouts with internal baffles have been applied successfully at times, but angle of descent must be steep and baffles may retard flow of wet coal, particularly fines. Where headroom permits, the cone-shaped distributor does the best job of all other alternatives.

The new chute design that we are describing represents an adaptation of the common flat chute, Fig. 1 and 2, which offers the advantages of ease of construction, relatively low cost, and adaptability to a wide variety of installation conditions. A feature of the new non-segregating design is the top plate, which is depressed in the center. It is either curved as shown in Fig. 2, which represents a close approach to theoretically correct design, or made of flat plates as in Fig. 3, which represents an easier-to-build and satisfactory design.

Why does this depressed-center design prevent segregation? To answer this question, let's first take a look at what causes segregation in a flat chute. In Fig. 1, note that coal flowing down

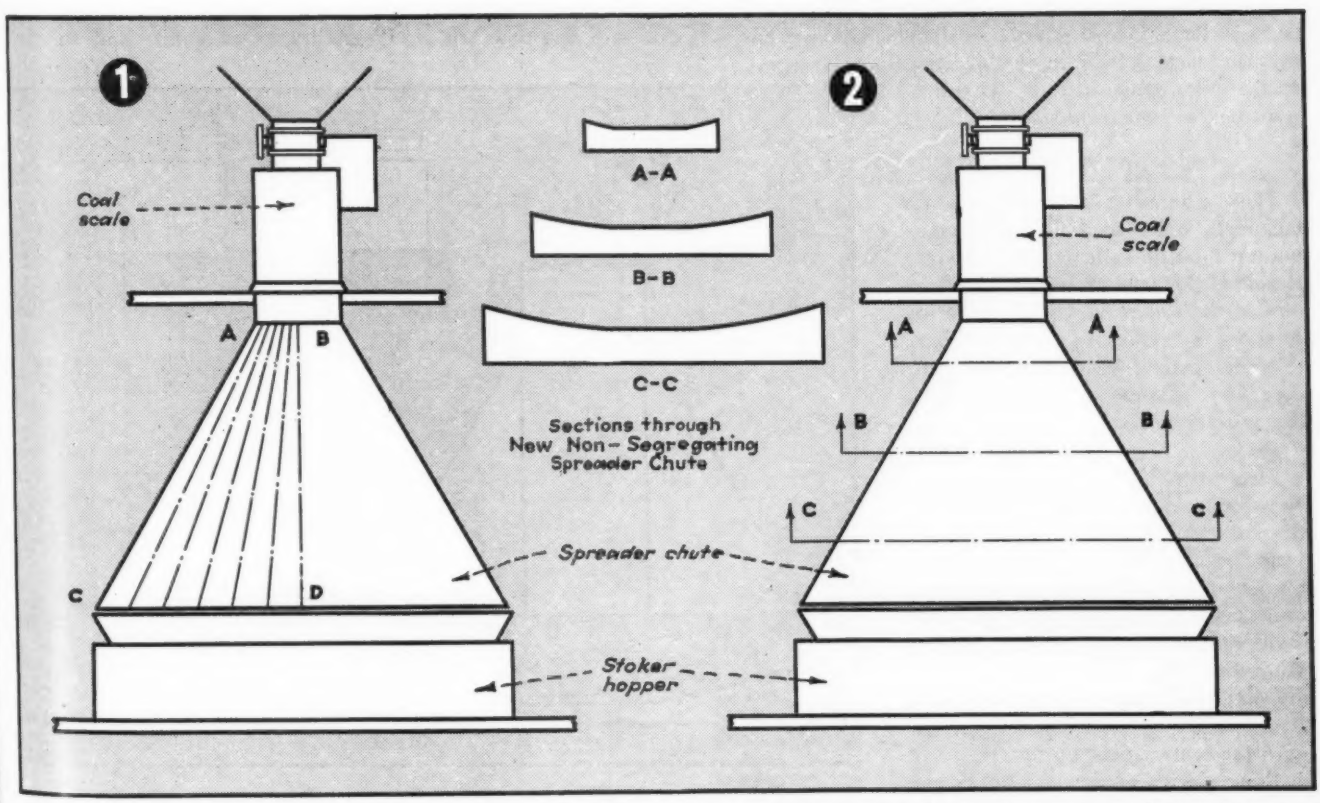


Fig. 1—Conventional flared-out spout of rectangular cross-section. Fig. 2—Non-segregating spout with center depressed, as shown in cross-sections. Note that headroom of new design is same as conventional one and could be reduced if limitations exist

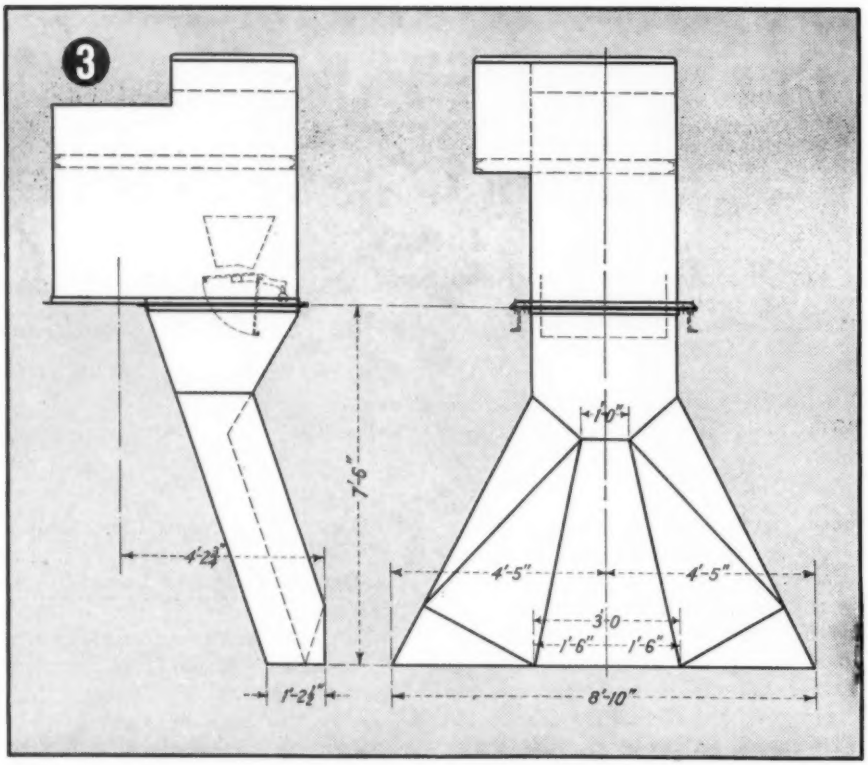


Fig. 3—Design for non-segregating chute, using flat plates to approximate the theoretical curves of Fig. 2, is easier to build and gives satisfactory results in practice

the outer edge, from *A* to *C*, moves faster than coal flowing down the center, from *B* to *D*, because it covers a greater distance in the same time. Picture a series of coal streams, moving progressively faster from center to edge. A lump in one stream, bordered by faster-moving coal on one side than on the other, tends to turn and roll toward the faster moving stream.

Cause of Segregation

Thus differences in velocity across the chute width tend to cause lumps, but not fines, to shift toward the edges. Result is the familiar segregation pattern in the stoker hopper. Because differences in velocity in the chute cause this segregation, we should be able to cure it by redesigning the chute to make the velocity uniform. How can this be done?

Remember that rate of flow depends on velocity and area, and that rate of flow across the width stays nearly uniform because the stoker rams take away about the same amount of coal at each point. We can see, then, that changing the area changes the velocity. What we really want to do is to change the shape of the chute across the width in such a way that the coal streams toward the center speed up progressively, so that velocity of the streams is uniform and there is no tendency to segregation.

The desired shape of cross-section can be found by analysis, as shown on the opposite page. Result is a *secant curve*, like those of Fig. 2. However, experiment indicates that approximations to this curve give good results; this means that chutes of this type can be constructed easily from flat plate without need for expensive bending.

Rebuilding the top plate, as in Fig. 4, converts an existing flat chute into a non-segregating unit; the average plate shop can easily handle the work. If the center is depressed too much, segregation occurs but "in reverse"; that is, lumps tend to creep toward the center, but this is not objectionable. A good rule of thumb is to make depth of section at center about half that at sides. Maintain a liberal section down the center; safe depth depends on size range of coal and angle of descent.

Design for New Spout

A new spout can be of similar construction to that just described, having a flat bottom plate and a top plate depressed in three planes, Fig. 3. Making the changes in the cross-section, by depressing the top plate only, keeps the bottom plate, which carries the greatest wearing load, flat. This means that it can be easily constructed of heavy-gage metal or equipped with a wear-resisting lining.

Chutes of the type described offer considerable flexibility of installation. The chute forms a direct connection between bunker gate, or automatic coal scale, and the stoker hopper. The operating principle remains effective at any angle on which coal flows by gravity, and the chute can even be placed vertically to take discharge of a bunker gate directly above the stoker hopper. Flexibility as to angle, and the fact

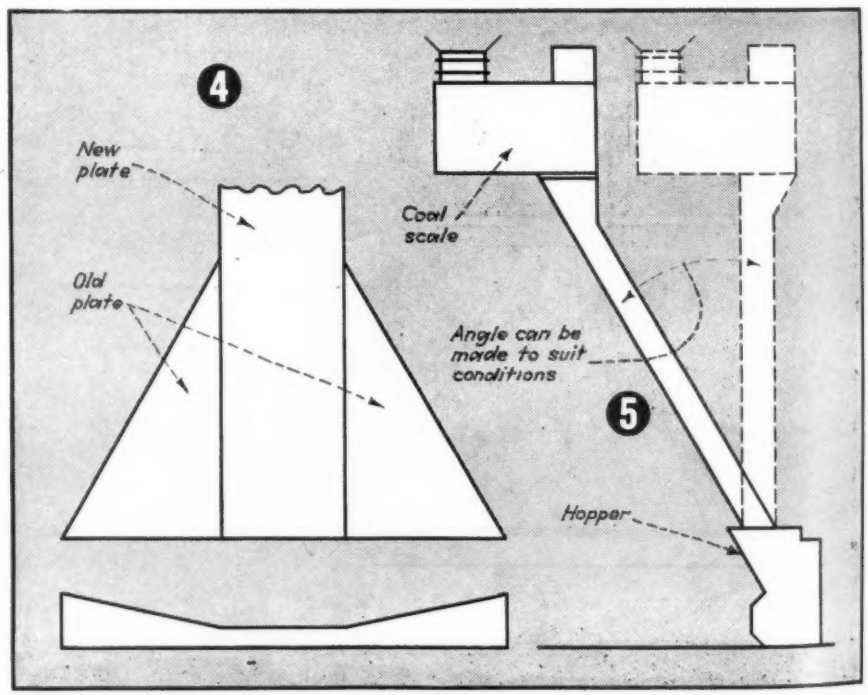


Fig. 4—Existing flat chutes can be converted to a non-segregating design by changing the top plate as shown. Fig. 5—Flexibility as to angle of incline of this non-segregating design makes it easy to meet headroom limitations or other special building conditions

that the chute connects directly to the bunker gate or coal-scale opening make this design particularly suitable for installations where headroom limitations must be overcome.

While a distributor of this type eliminates segregation from the bunker gate or coal scale to the stoker hopper, it performs no mixing functions and it is not intended to overcome or remedy segregation that occurs in the bunker. This calls for other remedies, usually applied in the equipment handling coal from storage pile to bunker. If an automatic scale is installed between bunker and a non-segregating chute, it is practicable to install mixing baffles within the scale unit to obtain a reasonable mixture before the weighing is discharged. The non-segregating distributor delivers this mixture to the stoker hopper exactly as received.

Editor's note: Permission to use the principles of construction outlined above and covered by patent 2,258,516 may be obtained from Richardson Scale Co.

Here's the Reasoning Behind the Design

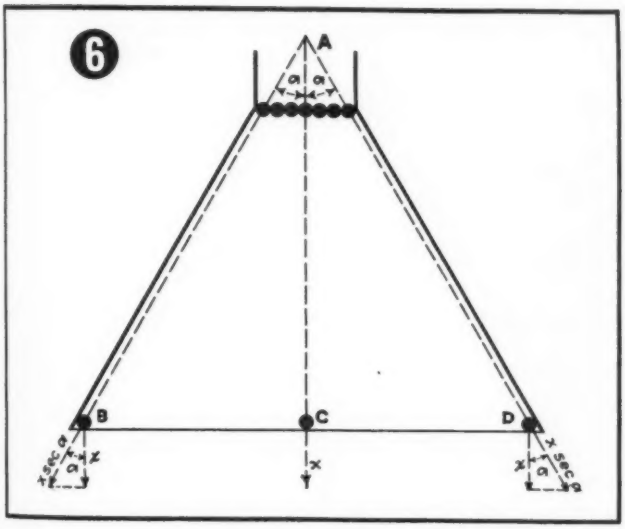
For the conditions under which a coal chute operates, the following statements apply:

1. The chute always flows full
2. The stoker takes coal at a nearly uniform rate across the width of the hopper

In addition, we assume there is no friction.

Referring to Fig. 6, velocity of coal moving down centerline *AC* is taken as x. Coal flowing down the outside edge, *AB* or *AD*, moves farther, so must have higher velocity to reach the bottom at the same time. If a is the angle the line of flow makes with the centerline, the velocity along line *AB* or *AD* must be $x \sec a$.

This variation in velocity leads to segregation, as explained



in the preceding part of the article.

Does this fit the condition that discharge must be uniform across the hopper width?

Rate of discharge = $area_A$ times $velocity_A$ = $area_B$ times $velocity_B$ = $area_C$ times $velocity_C$

Now the velocity referred to in the above equation must be along a vertical axis, perpendicular to the horizontal axis of the chute's cross section. In other words, we deal only with the vertical component of the velocity, which is x. We thus find that

$$velocity_A = velocity_B = velocity_C$$

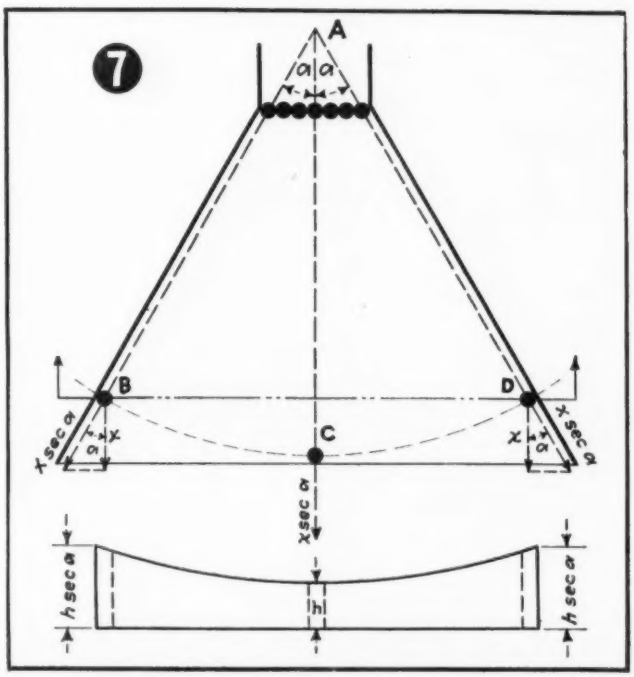
Thus the rate of discharge is uniform across the hopper.

It is apparent that to cure the segregation we must make the velocity in the line of motion uniform across the width of the chute. This can be done by altering the depth of cross section across the width in such a manner that the slower-moving streams of flow toward the center are speeded up to the velocity of those at the sides.

The desired condition would thus be one in which the velocity in any line of flow, from center to edge, would be the same as at the edge, or $x \sec a$. What shape cross-section will produce this result?

Refer to Fig. 7, which shows a chute designed with a curved upper plate. Inspection shows that this will tend to speed up flow at the center, because the area has been reduced and the rate of discharge must remain constant because of the stoker action. The problem is to determine the exact shape of this curved plate.

Consider sections of unit width across the chute. The area of each section will be proportional to the height. If we call the height at the center h and the velocity at the center is $x \sec a$, the discharge from the unit section will be $hx \sec a$. Now at the edge, the velocity in the line of flow is also $x \sec a$, that being the desired condition. But here again we deal with the vertical component of the velocity, which is x. It can then be seen that if the discharge from the unit section at the edge is to be the same as at the center, the height of the section must be $h \sec a$. With the vertical component of velocity shown to be x, the discharge from the unit section at the edge will be $hx \sec a$. This satisfies the condition of uniform discharge and we have shown that if the top plate is made in the shape of a *secant curve*, the velocity in line of flow will be made uniform, eliminating segregation, and the discharge will be maintained uniform across the stoker width.



Valves Can Make or Break Smooth Heater Operation

That's what Warren P Spining, Worthington Pump & Machinery Corp, says of inlet-water regulating valves in this discussion of direct-contact heaters and their problems

► EVEN THE BEST direct-contact heater, under fluctuating operating conditions, can remain stable over the entire load range only when equipped with proper controls. Most important of these from an operating standpoint is the inlet-water regulating valve and its associated float.

Entering water may come from several sources. Normally, water from at least one source is controlled by a float-operated regulating valve. The float, located in the water-storage compartment or in a separate chamber, opens and closes the regulating valve as the water level in the heater falls and rises, thus varying flow in accordance with demands of boiler-feed system.

Consider the effect on the heater of variations in the quantity of inlet water. While direct-contact heaters are rated in pounds per hour, bear in mind that they contain considerable storage capacity. Therefore, outlet and inlet flow are not necessarily proportional at all times, the difference being taken up by variations in amount of stored water. Thus, if the regulating valve is not properly selected and adjusted, inlet flow can greatly exceed outlet flow for short periods, and vice versa.

Under extreme conditions, a poorly selected valve may permit inlet flow to exceed the rated capacity of the heater even though the outlet flow may be well within rating. Such operation can result in periodic overloading of the heating element with consequent faulty deaeration. It can also cause severe disturbances in the low-pressure steam system feeding the heater.

Fluctuations in heater pressure may make these conditions worse. Increasing inlet flow causes the heater to condense more steam. If sufficient steam is not available to meet such increased demand, steam pressure in the heater tends to fall. The drop in steam pressure is, of course, reflected in a drop in pressure at the downstream side of the regulating valve, which causes still more water to enter the heater and thus further aggravate the condition.

Remember that the amount of water to be regulated is most of the time considerably less than the rated capacity of the heater. A common arrangement permits all condensate to return to the heater uncontrolled while makeup is regulated by a float-operated valve. If makeup at full load is normally only 10% of heater capacity, it would not be wise to select the regulating valve for full heater flow. Instead, select a smaller valve to give best regulation for the flow it normally handles. If, under emergency conditions, the heater must operate at full load with 100% makeup, then install a second valve and float for such conditions.

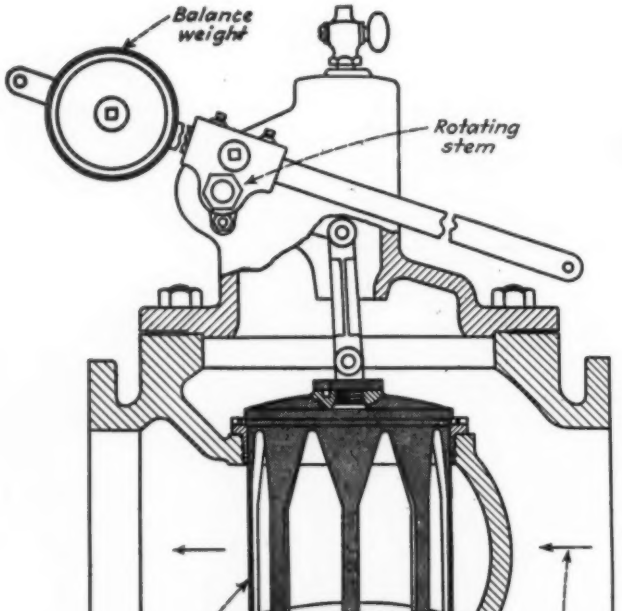


Fig. 1—Direct-acting double-seated V-ported inlet-water control valve with a gradual regulating characteristic. Rotating stem reduces leakage and friction in larger valve sizes

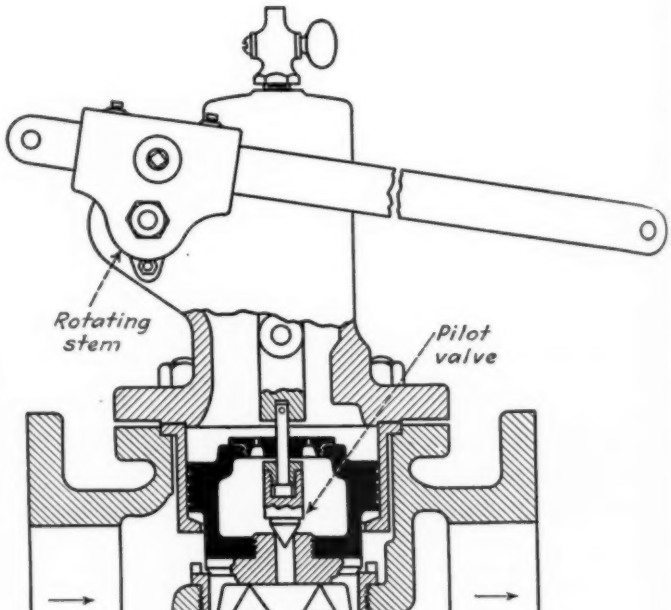


Fig. 2—Internal pilot regulating valve requires only sufficient external force to actuate the small pilot valve. Main disk follows motion of pilot using water pressure as driving force

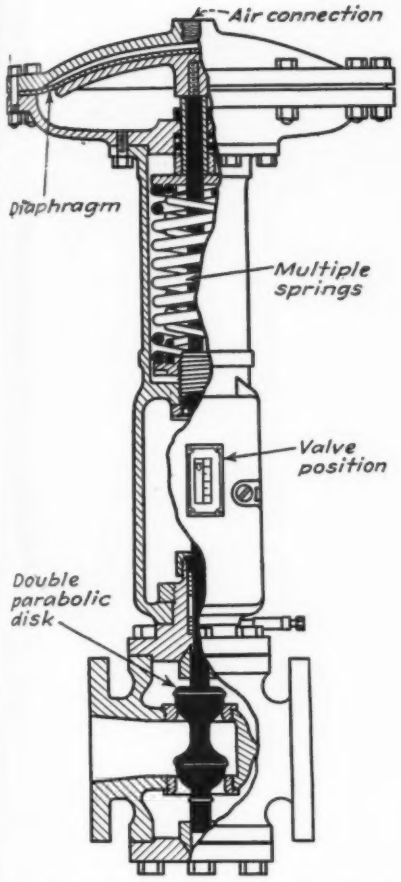


Fig. 3—Pneumatically operated valve is positioned by pilot valve in air supply to diaphragm. Air pressure works against spring to close valve

A similar situation arises when the major portion of the water entering the heater must be regulated and the heater must operate at times at very light loads. With a valve large enough to handle full-load flow, regulation is apt to be poor at light load. A combination of two or more valves with floats set at successive levels gives much better regulation over the entire load range than a single valve. The slightly higher first cost is usually well worth while from an operating standpoint.

Maximum pressure differential is not necessarily the difference between maximum pressure upstream and minimum downstream since these conditions may not occur at the same time. Likewise, minimum pressure differential is not necessarily the difference between minimum pressure upstream and maximum downstream. Rather, to arrive at actual differentials across the valve, upstream and downstream pressures must be studied in their relationship to each other. In determining these pressures, be sure to include all factors, such as static elevation of the heater, friction loss in vent condenser, and pipe friction in the system.

Having determined the range of flow through which the valve must regulate, the available pressure differential under various flow conditions and the temperature range, it is comparatively simple to select a valve of the proper size and regulating characteristic. For best regulation, select the smallest valve that passes the required amount of water under conditions of minimum pressure differential. Then, check this valve at maximum pressure differential to make sure it regulates satisfactorily down to minimum flow. If the disk must operate too close to its seat for good regulation under minimum flow and maximum pressure differential, consider one of the following solutions: (1) Find a valve with more gradual regulating characteristic. (2) Divide flow between two or more smaller valves with floats arranged at successive levels. (3) Modify or control the water supply system by means of a pressure-reducing valve or a differential pressure regulator to reduce maximum pressure differential to a smaller value under light-flow conditions.

Gradual Regulation

Select type of valve according to size required, maximum upstream or differential pressure, and location of valve in relation to heater. Basically, the valve should have a gradual regulating characteristic such as is normally associated with direct-acting double-seated V-ported valves, as in Fig. 1. The valve illustrated uses a rotating stem instead of the more usual sliding stem to reduce both leakage and mechanical friction at the stuffing box. In sizes of 2½ in. and smaller, standard sliding-stem construction is usually satisfactory.

A certain amount of unbalance is inherent in valves of this type since the two disks must be of different diameters to permit assembly. Direction of this unbalance is usually such that the differential pressure tends to open the valve. Any fluctuation of the steam pressure in the heater or the water pressure ahead of the valve may seriously affect operation by amplifying the consequent variation in flow. If, for example, the upstream water pressure were to increase, the flow would likewise increase, as would be expected. In addition, the increased pressure, acting against the unbalanced valve disk areas, would tend to open the valve wider, thus increasing the flow still more.

The remedy often lies in turning the valve around to reverse the direction of flow. In this position, increased pressure tends to close the valve, thus partially compensating for the increased flow caused directly by the increased pressure. Reversing the inlet regulating valve in this manner has greatly improved the performance of many existing installations.

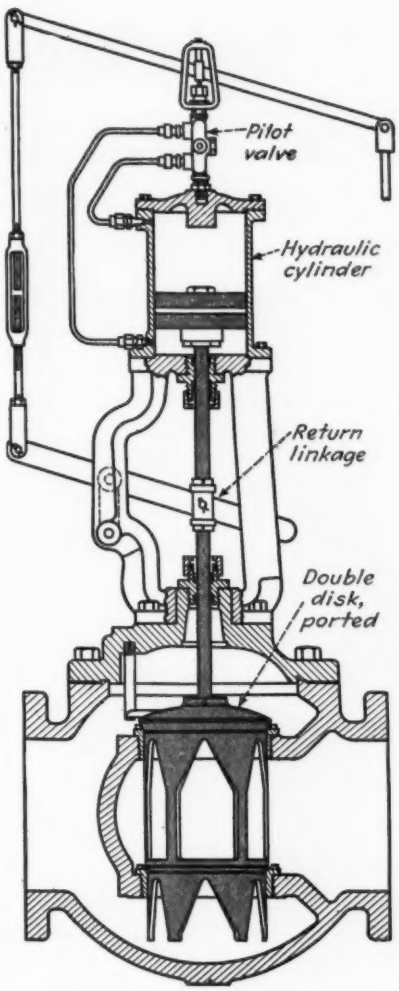


Fig. 4—Hydraulic piston valve avoids need for spring and diaphragm, but requires repositioning linkage shown to return pilot valve to neutral position

Direct-operated double-seated valves are somewhat limited by (1) their unbalance and (2) the fact that a certain amount of leakage can be expected, even when tightly closed. The former is serious only in large sizes or for operation with high differential pressures where the force required to operate the valve may exceed the force available from a float of reasonable size. The latter objection appears only when the valve regulates an emergency supply of untreated water, which it is desirable to exclude from the system except in case of emergency.

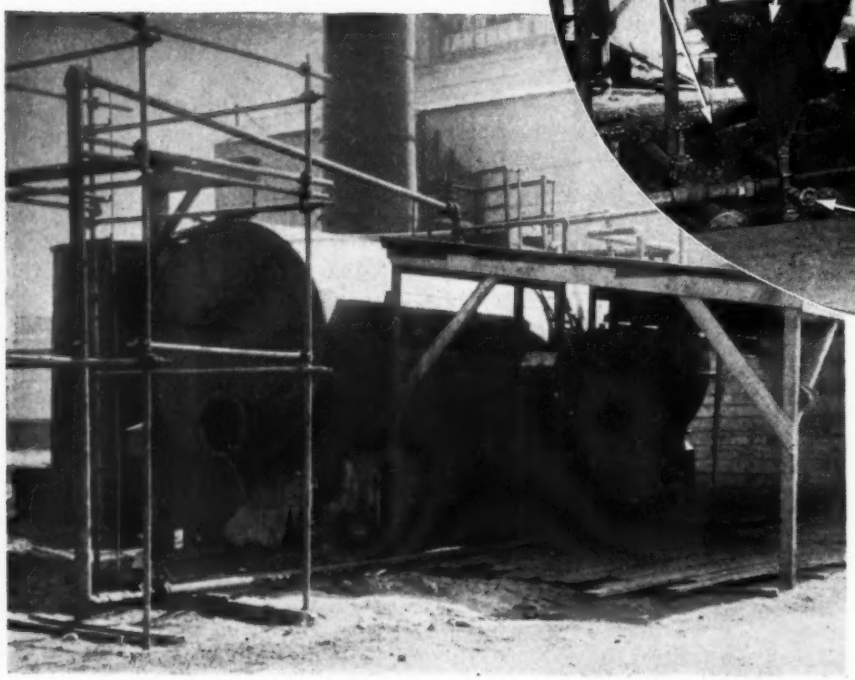
Both limitations can usually be overcome by an internal pilot valve, as shown in Fig. 2. Note that the outside force supplied by the float need only be sufficient to actuate the small pilot valve in the center of the main valve disk. Changing the position of the in-

(*Continued on page* 136)

Tests Reveal Colloidal-Fuel Performance

A month's operating trial at the Atlantic Refining Co, with no more than minor difficulties, shows results about equal to Bunker C fuel oil

By J F BARKLEY[1], L R BURDICK[2] and A B HERSBERGER[3]



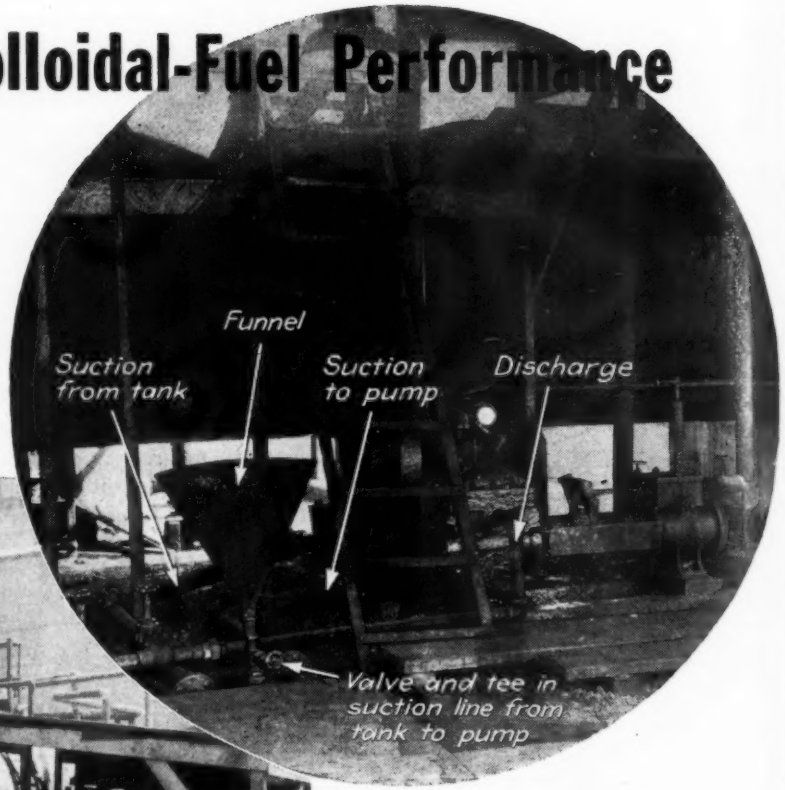


Fig. 1 (circle)—Mixing device, showing funnel for coal feed mounted on suction line from tank to pump. Fig. 2—General view of mixing arrangement, showing the two horizontal pipes of the discharge, the two orifices, the vertical pipe, and the horizontal pipe to top of tank

►WHEN FUEL OIL WENT TO WAR, many oil-burning plants were forced to turn to coal. But cost of installing coal-burning equipment runs too high for many plants; for others, physical limitations make conversion difficult or even impossible. Operators of a number of such plants are giving careful consideration to the emergency use in present equipment of mixtures of pulverized coal and fuel oil, popularly termed *colloidal fuel*, a substitute that saves about one-third the oil. Involved in their decision are questions of operating problems, fuel procurement and cost.

To the operator used to the relative ease of handling and burning fuel oil, pulverized coal added to oil is something in the nature of a contaminant. New operating problems, to be solved by properly organized operating routine, arise from the changed characteristics of the fuel. Colloidal fuel is about 10% heavier in weight per unit volume than oil; it is about seven or eight times as viscous; it requires more power for pumping and pump capacities are decreased; it is much more abrasive; if the coal does not stay in suspension, pastelike accumulations occur in various equipment parts, such as tanks, heaters and valves; ash from the coal in the mixture is set free in the furnace.

To obtain information on the operating problems involved, the Bureau of Mines, in cooperation with The Atlantic Refining Co, ran about a month's operating test on a colloidal fuel at one of the Atlantic boiler plants, in Philadelphia, Pa. The test was part of the regular plant steam production with the usual company operators.

Fuel was a mixture of 40% pulverized bituminous coal and 60% No. 6 (Bunker C) fuel oil, no "fixateur" or stabilizer being added. Previous research at the Atlantic laboratories on stabilities of mixtures showed about 40% coal to be the optimum amount.

Coals were high volatile bituminous of about 37% volatile and 5 to 8% ash, with ash-softening temperatures ranging from about 2300 to 2700 F. Oil had a viscosity of about 50 to 70 seconds Furol at 122 F. Viscosity of the mixture was about 300 to 500 seconds Furol at this temperature.

Three different batches of fuel were burned, the main difference being in the fineness of grinding the coal. Batches were ground to pass about 88, 95 and 99% through a U. S. Standard 230-mesh screen (62 microns), which is considerably finer than that ordinarily used at pulverized-coal-burning plants. The Atlantic laboratory research indicated that the finer grinding would be necessary for a colloidal fuel that would be reasonably stable.

In general, the mixing of coal and oil required for the tests was less difficult than had been anticipated. A

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[3] Research and Development Department, The Atlantic Refining Co, Philadelphia, Pa.

simple batch-mixing device shown in Fig. 1 and 2 was used. Fuel oil required for the batch, about 7000 gal, was put in the plant storage tank and then pumped from the tank suction line by an ordinary reciprocating pump. Its temperature was kept at about 85 F by steam coils in the tank. In the suction line, mounted on a tee and valve was a funnel, kept filled with pulverized coal.

The coal, under hand-valve control, was allowed to flow slowly into the oil stream on its way to the pump. The mixture was discharged by the pump through two horizontal parallel pipes, each having an orifice near the end, as shown in Fig. 2. The two streams of fuel met at the base of the vertical pipe and passed on to the storage tank. Fuel was spilled into the tank at two outlets, one at each end of the tank. Coal was fed into the oil at the rate of about 1500 lb per hr, fuel being continually circulated at the rate of about 9000 gal per hr. After the required amount of coal was fed for the batch, fuel was circulated about 12 hr.

Laboratory tests of fuel samples taken at various places throughout the tank showed a uniform mixture. Fuel was not recirculated further during the burning tests at the boiler plant, the mixing device being valved off from the suction line.

Boiler-plant equipment is typical of that of many oil-burning plants. The suction line from the outside oil-storage tank runs underground about 100 ft to the heater-pump set. A steam line that helps maintain fuel temperatures to the pump parallels the oil suction line. One pump is a reciprocating and the other, Fig. 3, a rotary. Fuel is heated to about 160 to 180 F at the set and pumped about 110 ft to the boiler. The burner is a standard Best steam-atomizing burner, shown in Fig. 4. Fuel reaches a horizontal slot at the burner tip through the lower pipe; steam reaches a vertical slot through the upper pipe and sweeps fuel into the furnace. Fuel and steam are under hand control.

The boiler is a 1510-sq-ft long-drum straight-tube B & W unit, eight tubes wide and nine high. Fig. 5 shows the boiler front. The furnace is brickset, 10 ft high at the front from floor to tubes, and 6 ft high at the rear. Furnace width is 5 ft, length 15 ft, giving

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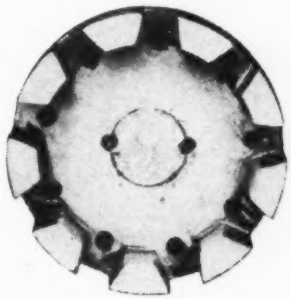
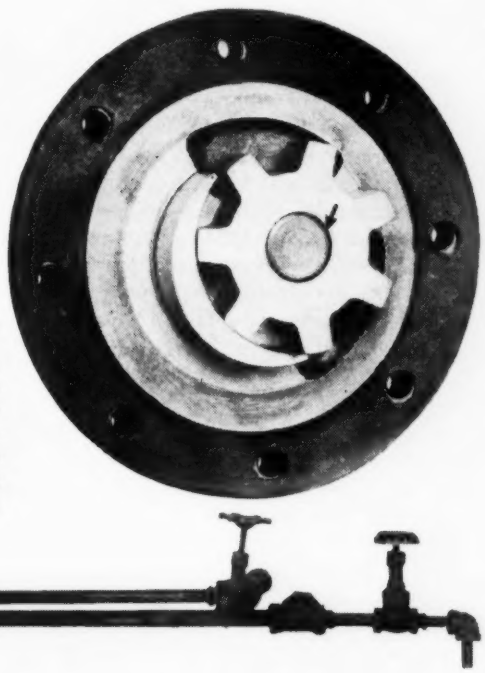




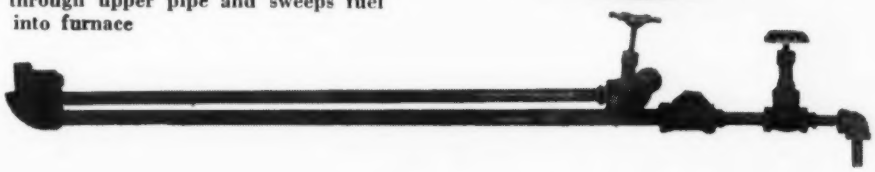


Fig. 3 (above)—Interior of rotary oil pump used as part of heater-pump set; most of erosion occurred at spindle. Fig. 4 (below)—Standard Best steam-atomizing burner; fuel reaches horizontal slot at burner tip through lower pipe, steam reaches vertical slot through upper pipe and sweeps fuel into furnace

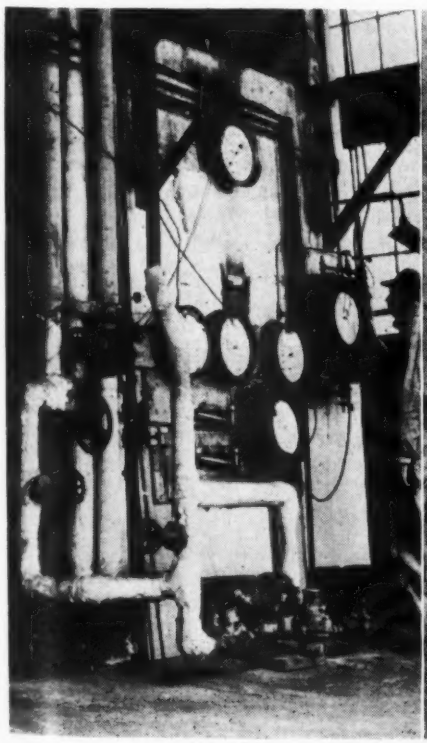


Fig. 5 (left)—Front of 1510-sq-ft long-drum straight-tube boiler. Fig. 6—Ash accumulation in furnace after about a week's run

Chlorine Detector Protects Workers Against Poisoned Air

T A H Jeffery, Detroit Edison Co, explains construction and operation of a novel device that detects chlorine gas in room air and gives warning for concentrations of 0.005%

▶ AN AUTOMATIC INSTRUMENT to detect and signal the presence of dangerous concentrations of chlorine in air has long been needed as a protection for both workers and building steel. As nothing of this sort was commercially available we developed one for use in our company. A reliable instrument, which is sensitive to one part chlorine in 20,000 parts air, is now in operation in the chlorination-equipment rooms of certain of our power houses. It requires little attention. Operation is based on the well-known affinity of chlorine for water and on the increasing conductivity of water with the rising chlorine content.

A small blower, Fig. 1 and 3, circulates air over a strip of glass cloth, kept wet by a slow trickle of water. From the lower end of the glass cloth the water drops into a conductivity cell, then overflows to drain.

When the chlorine concentration in room air reaches 0.005%, conductivity of the water in the detector increases to the point where, within two minutes, the relay operates an alarm, which is a lamp beside the door just outside the chlorination room.

In its present experimental form the device consists of two main units, *detector* and *control unit*. The detector, installed near the floor of the room to be protected, includes the items shown in Fig. 1 and 2. Briefly, a fan (5) blows the room air over the wet glass cloth (2). The resulting chlorine-bearing water (if chlorine is present in the air) enters the conductivity cell (3). Lowering the resistance of the water in the cell causes the relay to operate and light the signal lamp.

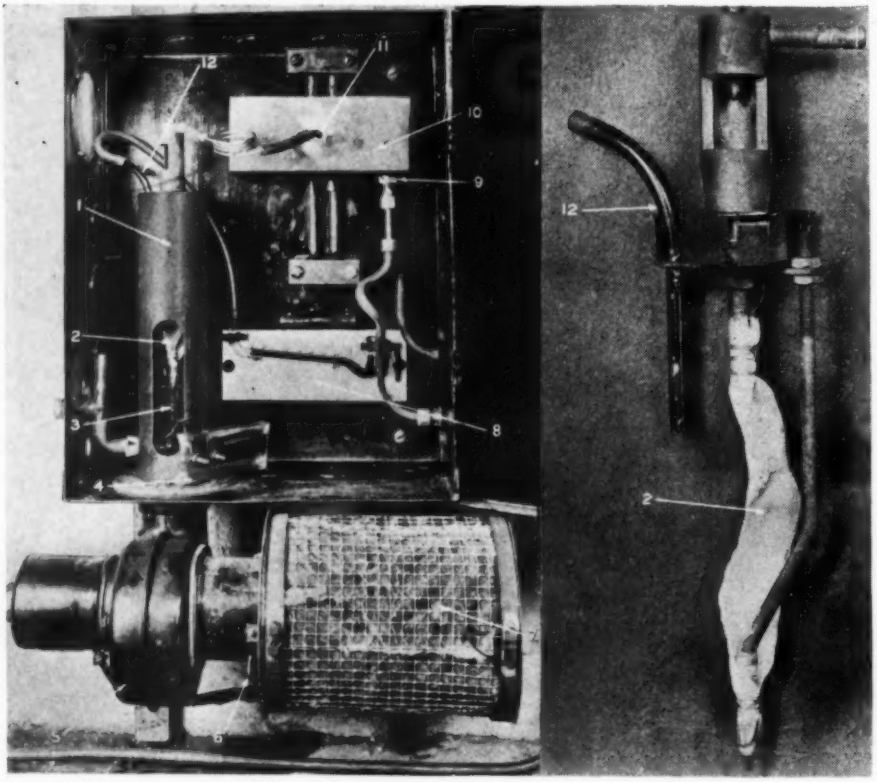


Fig. 1—Chlorine alarm detector unit: (1) support tube; (2) glass-cloth chlorine absorber; (3) conductivity cell; (4) window (removed); (5) blower; (6) damper; (7) filter; (8) inclined manometer; (9) water inlet; (10) constant-head device; (11) outlet from constant-head device; (12) total-pressure tube Fig. 2—Close-up of chlorine absorber showing glass cloth (2) and total-pressure tube (12)

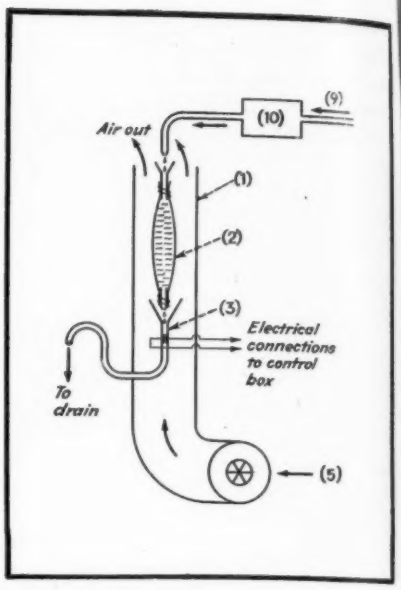


Fig. 3—Direction of flow through detector unit: (1) support tube; (2) glass-cloth chlorine absorber; (3) conductivity cell; (5) blower; (9) water inlet; (10) constant-head device to maintain steady flow

The adjustable constant-head device (10) controls the flow of water to the glass cloth while the inclined manometer (8), with a total-pressure tube (12), permits adjusting damper (6) to regulate air flow despite increasing resistance of filter. Window (4), which is detached in the photo, normally covers the long opening in upright tube (1).

Control Unit Described

The control unit, electrically connected to this detector, may be mounted either outside the room or in a vapor-tight box to protect the inclosed mechanical and electrical equipment. This unit, Fig. 4, includes: a transformer-type relay, (2) set to operate when the secondary series resistance (including the conductivity cell) falls to 40,000 ohms; a rheostat (1) to check operation of the relay; and switches (3) and (4). Fig. 5 diagrams the circuits.

Response of the detector is controlled by three variables: chlorine concentration in the air, rate of air circulation past the absorber, and rate of water flow down the absorber.

Fig. 6 charts cell resistance against time, for air containing 0.005% and 0.010% chlorine. In each case, the relay operates the alarm when the cell resistance falls to 40,000 ohms. Note that when the chlorine concentration

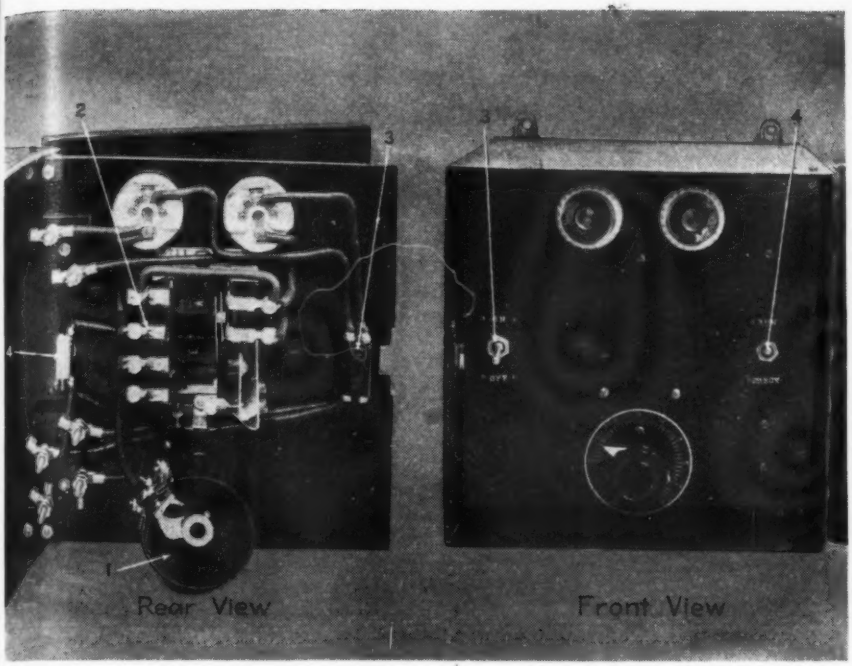


Fig. 4—Chlorine-alarm control unit can be located away from the detector or otherwise protected by a vapor-tight box: (1) rheostat; (2) relay; (3) and (4) switches

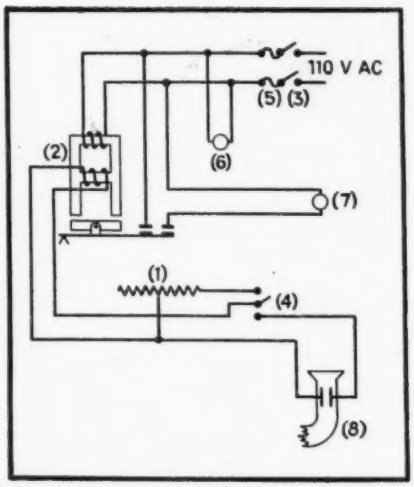


Fig. 5—Schematic circuit: (1) resistor, 50,000 ohms, wire wound; (2) relay, 110 v, ac primary—440 v secondary; (3) switch, 250 v, 1 hp, DPST; (4) switch, 250 v, 1 hp, SPDT; (5) fuses, 3 amperes, plug; (6) lamp to indicate device in operation; (7) alarm lamp; (8) conductivity cell, flow type (cell constant—1.3 reciprocal centimeters)

was doubled, time to signal the alarm was cut about 70%, as shown by intersection of the two curves at 40,000 ohms with the vertical time lines.

Effect of Velocity

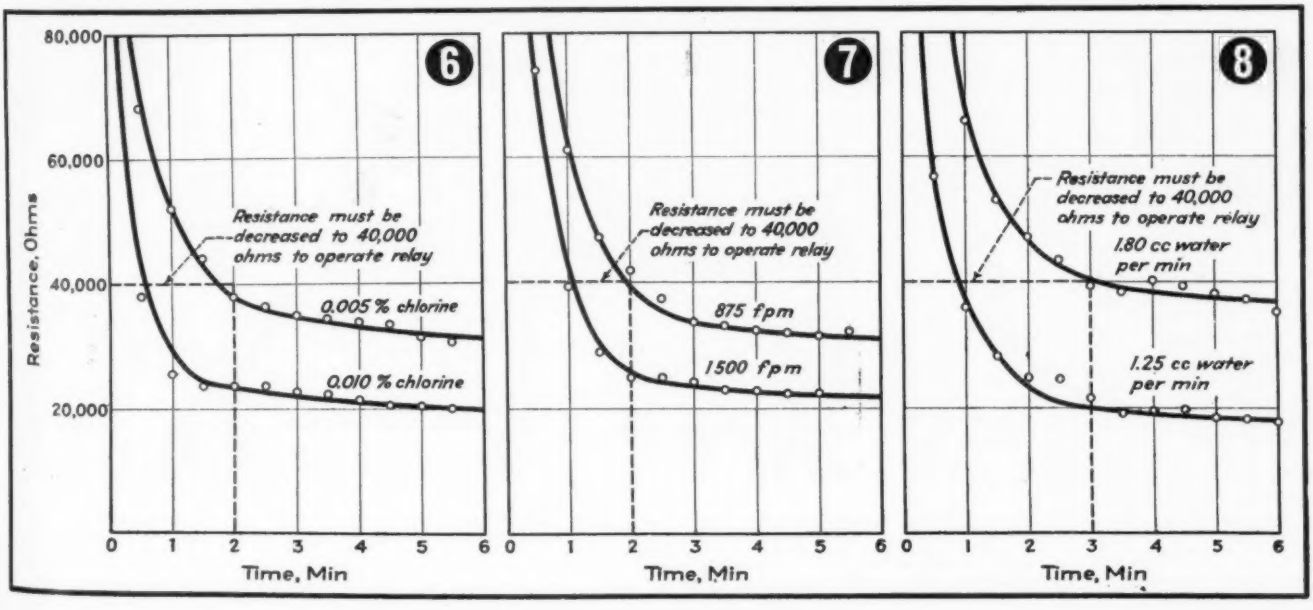
An increase in air velocity past the chlorine absorber from 875 to 1500 fpm (Fig. 7) cut response time by about 45%. Data for these curves were obtained while maintaining the chlorine concentration at about 0.007% and water flow at about 1.5 cc per min.

An increase of water flow to the cell from 1.25 to 1.80 cc per min (Fig. 8), while holding chlorine concentration at 0.007% and air flow at 1050 fpm, increased the response lag about 230%. However, the increased flow of water through the cell speeds its recovery after room air is free of chlorine. Although accurate measurements could not be obtained with the available instruments, repeated tests indicate that conditions are about as charted.

Water flow of 1.5 cc per min has been chosen for everyday operation because of these tests and because that rate can be maintained easily with a minimum of service. The operating air flow of 1050 fpm was chosen to permit regulating air flow (by damper adjustment) as the filter loads with dirt. Fig. 6, 7, 8 show effects of variations in chlorine concentration, air velocity and velocity of water flow.

The device, adjusted in this manner, consistently flashes the alarm when the chlorine reaches 0.007%, and does so within a reasonably short time. This concentration is well within safe limits for both operators and equipment.

Fig. 6—Effect of chlorine concentration in air on rate of decrease in cell resistance (air velocity equals 1050 fpm. Water rate equals 1.5 cc per min., Fig. 7—Effect of air velocity on rate of decrease in cell resistance. Chlorine concentration equals 0.007%. Water rate equals 1.5 cc per min. Fig. 8—Effect of water flow. Chlorine concentration equals 0.007%. Air velocity is 1050 fpm



By the time you read this, these engineers recruited from shore operating jobs will have finished their 5-week training at Sheepshead Bay. Many will be aboard ships for a two-month trial

► FIVE WEEKS SEEMS like a long time to a schoolboy of any age, but it runs out pretty fast when you are trying to absorb all the information you can get about a ship's power plant, take psychological tests, stand practice watches and soak up typhoid and tetanus shots. Men training for marine engineer positions at Sheepshead Bay (Brooklyn, N. Y.) training station of the U. S. Maritime Service say they have just time enough for sampling the wares of cook-and-baker schools between lifeboat drills and the next class hour.

In Full Swing

More than a hundred engineers with no previous sea time have proved their shore background satisfactory, been okayed by the doctor as physically able, established their citizenship and started training. Many are already on ships for two months or more of vital sea experience.

Some have left well-paid shore positions as top men in their own plants; younger candidates must have at least two years engine and boiler experience to offer; all get considerate treatment at enrolling offices and in training school. Men with best experience records, however, have best chances of rapid advancement.

Any man interested in becoming a marine engineer officer can check his own background against those now in training. Typical of the better records on file are the several case histories detailed here for comparison.

A 34-year old officer candidate from Waupun, Wisconsin holds a second class stationary license issued in Racine. He has had six years experience as chief engineer in two state hospitals with 150-psi boilers, a couple of Harrisburgs, an air compressor installation and auxiliary equipment. Another hailing from Ohio worked two years as a fireman in a large industrial plant, two more as repair machinist and another couple as operating engineer. The plant included six 5000-sq-ft Stirlings, three engines and two turbines.

A stillman from a California refinery

Official U. S. Maritime Photo

Fig. 1—Ship terminology and auxiliary equipment differ from shore practice. Here Weiger Visser, instructor, explains the telegraph system to Charles Patterson (Sioux City, Iowa) James Childers (Metropolis, Ill.) Carl Dei (Milwaukee, Wis.) and Louis Hill (Somerville, Mass.)

has earned a third class license in Montana. In addition to his six years in the refinery he can show records of three years as repair man, three more of diesel operation and a year running an absorption refrigeration plant.

A Chicago stationary licensee worked four years in the engine and boiler rooms of a large department store before acquiring the title of chief engineer, which he held two more years. An Ohio lad settled down to five years of steam and diesel operation after nine years as a locomotive engineer.

Experience Plus

These men, of course, have more than the minimum requirements. They have a background of basic training that will stand them in good stead at sea. Enrolling officers and Coast Guard inspectors welcome them for the good of the service that still needs many more of their kind.

Minimum experience, for the sake of the record, must include at least two years as the equivalent of watch engineer in responsible charge of both prime movers and boilers operating at 150 psi or more or equivalent diesel experience. Without this background a man can't be accepted for training. Those who can produce additional skills in refrigeration, machine shop, or electrical apparatus maintenance are better equipped to take advantage of the all-too-brief training period to move upward to responsible positions at sea.

Men like Sheepshead Bay training station. Instructors are all business. After the first period of hectic processing, photographing, physicals, issuing of liberty cards and uniforms, there are never enough hours in the day to absorb information freely handed out.

Out of School

At the end of five weeks, officer candidates take an examination before Merchant Marine Inspectors. Without sea experience they are limited to Junior Engineer (unlicensed) tickets. They register with the War Shipping Administration and are given a subsistence allowance during the necessary mechanical operations of getting them aboard ship.

For the present, officer candidates must expect to serve their sea time in any engine-room job available. Lack of sea experience limits ratings under which trainees can ship in accordance with long-standing regulations. To acquire first-hand familiarity with ship practice, officer candidates can serve well in less responsible positions for the few months required before a full license can be granted.

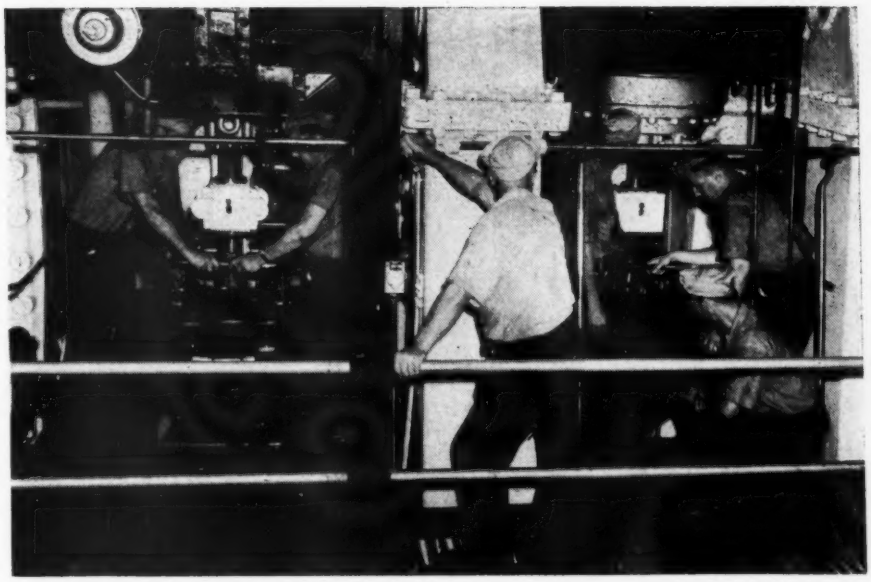


Fig. 2—Instructor Visser keeps a watchful eye on five trainees checking bearings of a large marine engine. You would have to know them well to recognize Leroy Johnson, Otto Hage (Fuldo, Minn.) Edward Norton (Marinette, Wis.) Carl Laughridge, (Des Moines, Iowa) and Charles Stone (Lawrenceburg, Ind.)

Fig. 3—Every week a new class of engineers lays aside problems of rationing for concentrated attention to ship machinery. Relaxed conversation with the instructor (center right) aids digestion of mental images along with more solid nutriment.

Fig. 4—Instructor Harry Wertheim holds a question bee on the workings of a ship boiler panel with Gove, Jennings, Childers, Dei, Goodheart, Jones, Galatch and others.

THE OLD CHIEF

Wayside Visits

Driving away from the old plant bent on vacation fun, the Chief still had an eye in his travels for the human side of engineering. Another in the distinctive series by William Doran, chief engineer of the Essex County Sanatorium, Winsor, Ontario

"No, this coal is unheavy," said Greenhouse Gertie

▶ I OFTEN THINK that a man receives just as much pleasure planning his annual vacation as he does from the holiday itself. Back in the days when touring was possible, my family and I would start poring over maps shortly after Christmas. Our planning would continue with weekly alterations and revisions until the day we started off.

One year, our proposed journey was to take us past the largest power plant in the state. Knowing that the Old Chief was a friend of the superintendent, I asked him to give me a letter of introduction in order that I might visit the plant.

"Sure," the Old Chief agreed, "you will see something worth while there, especially if they have some of the stuff torn down."

The Old Chief went on to discuss plant visitations in general. He had a preference for wandering into small one-horse plants where he thought you were more than likely to find the unusual, the ingenious and, sometimes, the astounding.

The Dancing Engine

Scenting a story, I quizzed him regarding some of the odd things he had run across in his travels. Soon I was hearing about the time he wandered into a small tomato canning plant.

Walking into the boiler room unchallenged, the Chief noticed a simplex steam engine. "For a moment," he said, "I thought I was going to be seasick. The engine, which was used to drive line shafting, was *dancing an inch backwards and forwards at every stroke*. I rushed to find the engineer, who was calmly smoking his pipe at the back door. I pointed out the horrible sight to him."

"Oh, that," he said, "that's nothing. You get used to it. It's been doing that for a while. We're closing down day after tomorrow. Guess I'll have ter grout in them dern studs again."

When Anything Goes

Commenting on the story, the Old Chief added, "It just goes to show how easy it is for any one, particularly the fellow who is inclined to put things off, to become reconciled to almost any kind of condition in his plant."

On another occasion the Old Chief visited a tannery, mainly to secure some inside information on the condition of the trout streams, and incidentally to chat with the owner and engineer of the shop.

The tanner complained that since he had installed a stoker, he had been unable to find lining that would stand the heat of his fire doors. The cause was not hard to find. The man who had converted the boiler to stoker firing had neglected to increase the space between bridgewall and shell, with the result that all the heat was bottled up over the furnace. "You could toast bread 20 inches away from that fire door," added the Old Chief. He pointed out that you are likely to find extreme cases in small plants.

Following that incident, temperature recordings were made in our own boilers that resulted in some beneficial changes in the passages of one of our boilers that was causing trouble.

Driving down the Rendo Valley one spring, the Old Chief and a few friends noticed a good-sized greenhouse with a long streamer of smoke trailing from the smokestack. Thinking that they might pick up some early vegetables to take home in place of the fish that refused to bite, they wandered over to the boiler house. To their surprise, they saw a woman wheeling a wheelbarrow of coal to the front of two sectional heating boilers.

"Are you the fireman?" they asked.

"Ya," replied the woman, evidently from the Low Countries, "the boss says the mans no goot with the fires. I fix 'em all the time."

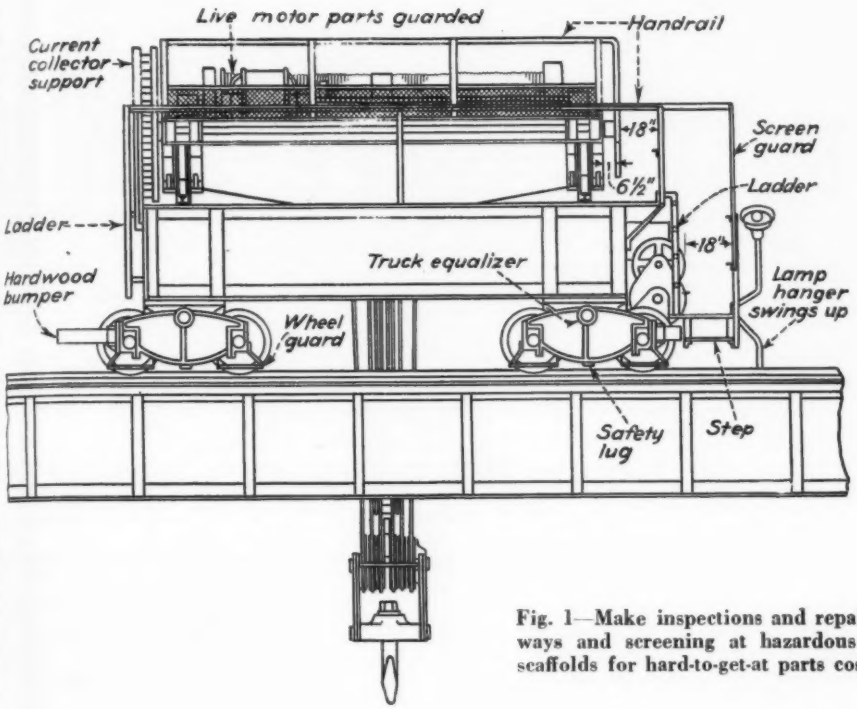
"But," the party asked, "don't you find that wheelbarrow of coal too heavy for you?"

"It is unheavy," said the lady. "In the old country I work in dairy farm. Each day I wheel barrow of cow manure. No, this coal is unheavy."

About William Doran

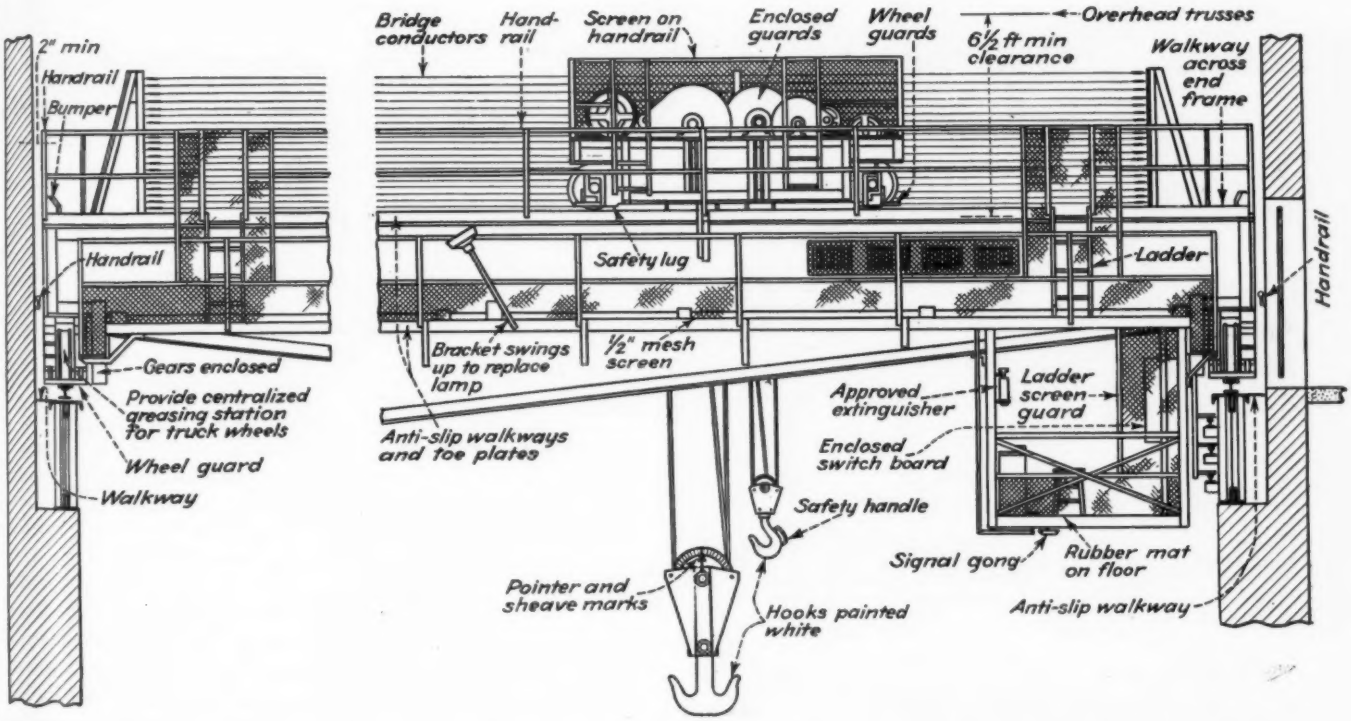
Just as the August issue goes to press, the author of the Old Chief series writes the Editor that he's off for a vacation and hopes to spend a few days of it with his son, who holds a commission with the famous Essex Scottish Regiment. He's taking his fishing rod along, too, and says he and the Old Chief will fish up some reminiscences for the coming year. So be on the lookout for the treats that are in store for you.

Looking at Crane Hazards Through a Safety Engineer's Eyes—



Shows how the right sort of planning eliminates accident risks. How about accessibility, for instance, says W E Rossnagel, safety engineer. Can you reach or repair the crane without constant danger of falling or being caught between unprotected pinch points or uncovered gears?

Fig. 1—Make inspections and repairs easier and safer by adding railings, walkways and screening at hazardous points. Frequent use of temporary sling scaffolds for hard-to-get-at parts costs more than attaching permanent platforms



▶MAKING THE CRANE STRONG enough to handle its rated load is only a start toward preventing accidents. Next, the design engineer concentrates on making inspections and repair work easier and safer by the addition of railings, walkways and toe plates. Include these requirements in crane specifications and thus the parts, added during erection, can be used to inspect bearings and motors during the breaking-in run.

Operating department and construction inspector follow the erection and are responsible for specified parts being added before placing the crane in service. The plant designer is responsible for providing an anti-slip walkway, secured to the runway girder, with

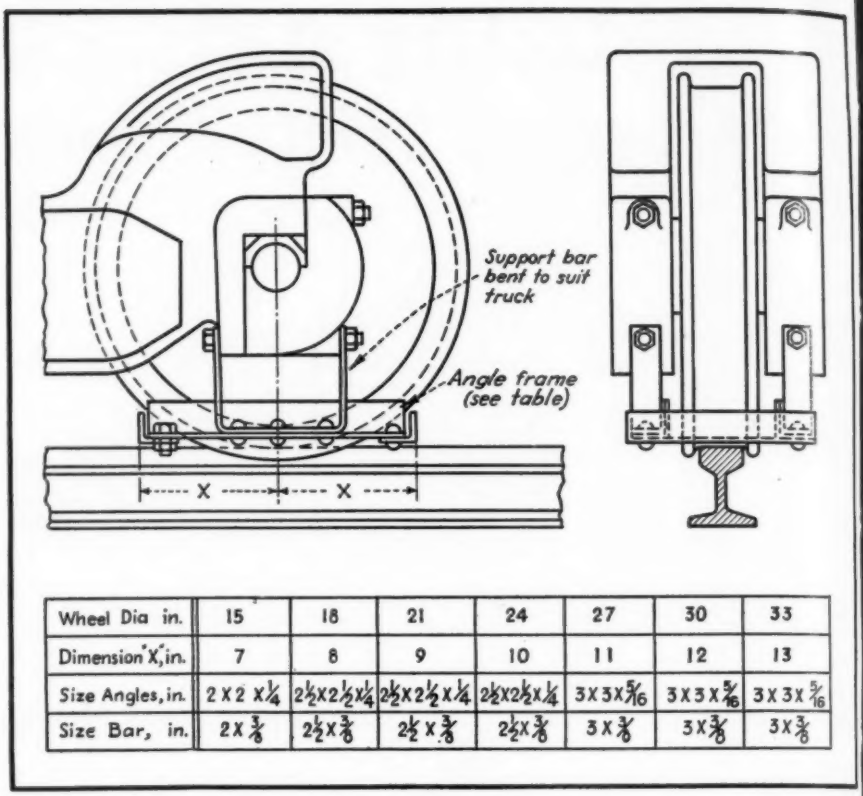
necessary handrail 3½ ft high and clearing adjacent walls or pilasters at least 1½ in., for safe access to the crane at any position on the runway.

Typical of the many details that need attention during the early stages of crane design are the following:

Walkways and handrails. Locate walkways on the crane bridge at motors, shaft bearings, contactor boxes and other equipment that needs frequent inspection. Walkways across end frames provide passage from one crane girder to the other. Use grab irons when handrails would interfere with trolley movement. Install anti-slip footwalks at least 12 in. wide, substantially supported and rigidly braced. Whenever possible, equip each walk with a substantial handrail 3½ ft high with wire screening fitted between the intermediate rail and the 6-in. toe plate that extends above the floor plate. Allow 6½-ft head clearance between walks and overhead trusses. Cover all openings between walkways and girders with wire screening having mesh openings not larger than one-half inch.

On bridge girders. If the girder's top is more than 3 ft above the walkway, construct an additional handrailed walkway along the top and provide a standard ladder at each end, connecting these walkways. Provide basket guards or similar protection for ladders in exposed places.

Miscellaneous safety devices. Trolleys on large cranes should be completely floored with steel grating or plate. Provide toe plates around all openings and along all floor edges. Provide



Wheel Dia in.	15	18	21	24	27	30	33
Dimension "X", in.	7	8	9	10	11	12	13
Size Angles, in.	2 X 2 X ¼	2½ X 2½ X ¼	2½ X 2½ X ¼	2½ X 2½ X ¼	3 X 3 X 5/16	3 X 3 X 5/16	3 X 3 X 5/16
Size Bar, in.	2 X ⅜	2½ X ⅜	2½ X ⅜	2½ X ⅜	3 X ⅜	3 X ⅜	3 X ⅜

Fig. 2—Follow dimensions (above) when fabricating wheel guards to provide a rigid barrier that will remove obstacles from the rail and will not vibrate loose

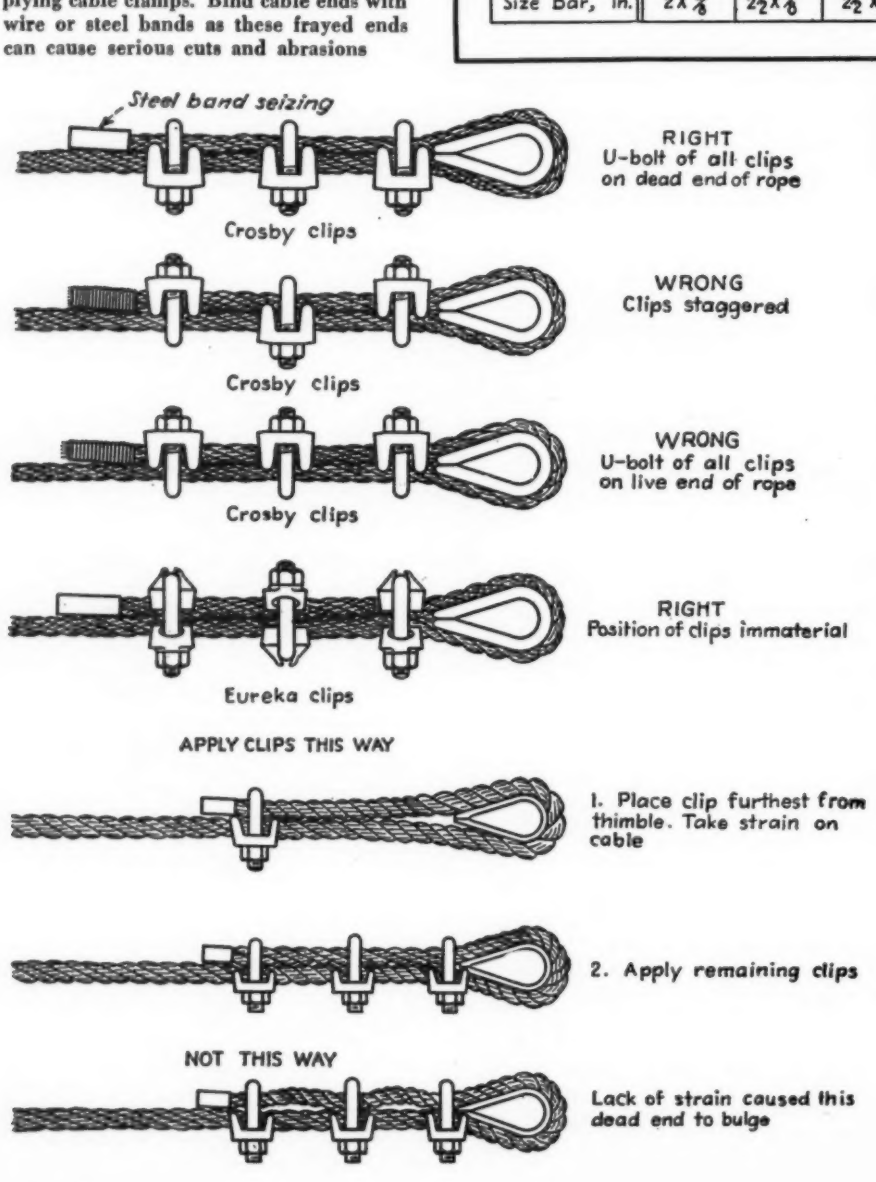


Fig. 3—Follow pointers (below) when applying cable clamps. Bind cable ends with wire or steel bands as these frayed ends can cause serious cuts and abrasions

How to Space Clips

Cable, in.	*Number Required*	*Spacing, in.*
1/4	2	1 1/2
3/8	2	2 1/4
1/2	3	3
5/8	3	3 3/4
3/4	4	4 1/2
7/8	4	5 1/4
1	4	6

handrails, grab irons and steps where necessary for safe access to motors and brakes. A safe means of access to the current collectors mounted below the crane trolley speeds up inspection.

Crane clearance. When crane operates directly under the roof, at least 12-in. clearance is needed between crane and overhead roof trusses. Two-inch end clearance between crane and building walls or other stationary structures prevents rubbing when truck wheels have considerable end play either in their bearings or on the crane rail. When two crane runways parallel each other allow at least 24-in. clearance between cranes.

Bumpers and fenders. Bumper rail stops should be at least one-third of the truck wheel diameter in height. Fasten both truck wheel and trolley bumpers to the girder rather than to the rails. Build up bumpers of plates and angles, or of steel castings. Truck wheel fenders, extending to top of rail and projecting in front of all bridge and trolley track wheels, should be attached to the trolley or to the bridge-end frame. Shape fenders to a form that tends to push or raise a man's hand, arm or leg off the rail and away from the wheel.

Limit Truck Drop

Safety lugs. Heavy lugs or brackets, placed on trolley frames and bridge-end carriages, limit a drop to one inch or less if a wheel or axle should break.

Potentials above 220 v. Cover the entire floor of the operator's cab and the floors at all motors and switchboards with heavy rubber mats when potentials above 220 v are used.

Uniform operation. For uniform crane operation, arrange controls in the following order beginning at operator's right: Bridge motion, trolley motion, main hoist and auxiliary hoist. When additional trolley or hoist controls are required, install them at the operator's left. Connect drum controllers to operate as follows:

Bridge controller: to right, travel right; to left, travel left.

Trolley controller: to right, rack out; to left, rack in.

Hoist controller: to right, lower; to left, raise.

For vertical levers, have the motion away from operator correspond to the right-hand motion of a drum-controller handle. Use enclosed controllers and provide them with dead-man handles or foot-operated contacts to cut off the current automatically when pressure on the handle or pedal is fully released.

Fire and safety regulation. Installation of switchboard wiring and all other electrical equipment must comply fully with safety regulations of U. S. Bureau of Standards and the fire-prevention regulations of the National Board of Fire Underwriters. Install the main-line switch or its equivalent so as to cut off all power to the crane and so that it may be locked securely in its open position.

Handles on control ropes. To reduce the possibility of grabbing the wrong handle, all handles of floor-operated cranes should be different. Mark the motion controls plainly on each handle or rope. Where practicable, thread these ropes through holes in a 1x2-in. wooden strip, or other similar spreader, which rests on the rope handles. Such a device prevents ropes entangling and assures handles always being in the same relative position.

Brakes. Provide a suitable brake on the bridge motion. Fit each hoist with an effective solenoid brake and a mechanical-load brake, each capable of holding full-rated load. The load brake may be omitted on cranes for bucket operation exclusively.

Travel-limiting device. Protect each hoist with a travel-limiting device, operating directly from the rising load block instead of being actuated by the drum shaft. If a paddle or arm device is used, each paddle or arm should be placed between the cables and extend across the entire lower block so that a swinging load cannot fail to strike it. Limiting devices must break, not close, the circuit in functioning.

Cable Drum Pointers

Cables and drums. Cable drums need a flange at each end to prevent ropes getting off the drum. Have drum large enough to hold at least two full wraps of hoisting cable in the grooves when the hook is at its lowest possible position. Use a hook block that lifts vertically without twisting. Paint the hook white and provide it with a handle. Protect bottom sheaves by close-fitting guards to prevent displacing the rope and to keep riggers hands from being caught between cable and sheave.

Sheaves and drums. They should have a mean diameter not less than 30 times the rope diameter for 6x19 Warrington lay rope, or 20 times the diameter for a 6x37 or 8x19 rope. The equalizing sheaves must have mean diameters at least 16, 11 and 12 times the respective rope diameters. Use hoisting ropes of plow-steel or improved plow-steel quality. Install guards at the contact point of the cables on the sheaves in load blocks of five-ton capacity or less.

(*Continued on page* 150)

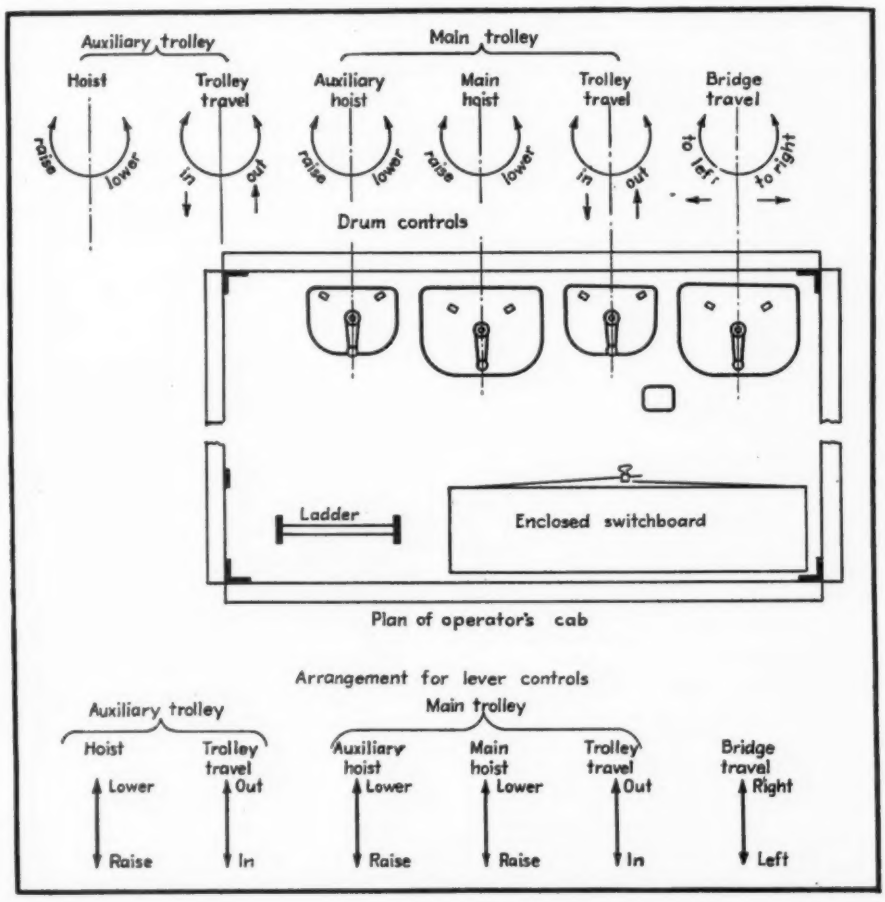
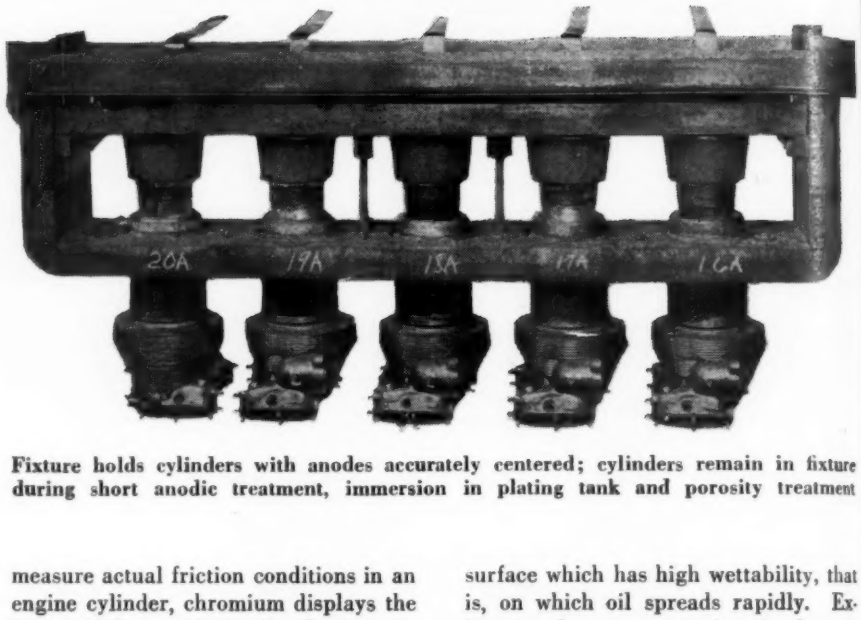


Fig. 4—Make the operator's cab large enough to hold the equipment and at the same time give him room to move around. Plan for uniform controller operation

Is Chromium Plating the Answer to Diesel Liner and Ring Wear?

Experience reported at National Oil and Gas Power Conference indicates that plating liners or rings shortens "run-in" period, reduces wear and increases time between overhauls



Fixture holds cylinders with anodes accurately centered; cylinders remain in fixture during short anodic treatment, immersion in plating tank and porosity treatment

► HARDNESS, HIGH THERMAL CONDUCTIVITY, low friction, low affinity for other metals, and corrosion resistance form the inherent properties of porous chromium platings which contribute to their low wear rate in engine cylinders, according to Russell Pyles, chief engineer, Van der Horst Corp of America, who spoke at the 16th National Oil and Gas Power Conference of the Oil and Gas Power Division, ASME, held June 14-16 in Baltimore.

Chromium is harder than any other metal in general use for engine cylinders, said Mr Pyles, and this hardness maintains throughout the case thickness and over the range of cylinder-wall operating temperatures. Neither hardness or wear resistance of the base metal need be considered; with a chromium-plated surface, ordinary cast iron or low-carbon steel may be used for the liner unless strength requirements dictate alloys.

Chromium's linear expansion coefficient is lower than that of cast iron or steel but this does not seem to cause bond failure. The fact that temperature rises sharply from the jacket side of the liner to the cylinder side may help to account for the successful bonding, the chromium plate, with its low coefficient, being on the high-temperature side.

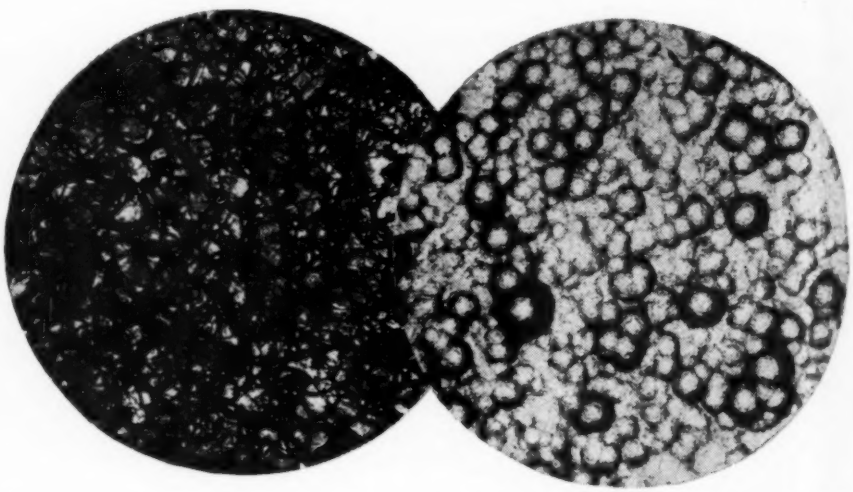
Thermal conductivity of chromium exceeds that of steel or cast iron by about 40%. Improvement in heat transfer results in lower wall temperature and improves piston and ring lubrication. Photomicrographs show no space or voids between plate and base metal; this close bond interposes no barrier to heat transfer.

Although simple friction tests fail to measure actual friction conditions in an engine cylinder, chromium displays the lowest sliding and rotating friction coefficients of any metal tested.

Corrosion resistance of chromium is high, particularly with respect to hydrogen sulphide and the sulphur compounds in general. It is unaffected by nitric acid and saturated ammonia solutions, but hydrochloric and bromic acids dissolve it.

Porous chromium, as used in engine cylinders and on piston rings, differs from hard chromium in surface condition. After plating current is applied in the usual manner, current is reversed and electrolytic etching takes place. This produces a rough, porous surface which has high wettability, that is, on which oil spreads rapidly. Existence of pores or crevices in the surface reduces net contact area which, in combination with the high thermal conductivity of chromium and its high melting point, helps to account for the high load capacity of porous-chromium-plated cylinders.

Cylinders or liners to be plated are first honed, then assembled in fixtures with accurately centered anodes (see photo above). A short anodic treatment follows and then the fixture is immersed in a plating tank where chromium is deposited at high current density. The fixture and cylinders then go to an etch tank, where reversed



Photomicrographs (100x) of outside diameter surface of hard-chromium-plated cast-iron piston ring (left) and of porous-chromium-plated piston ring (right)

current strips off part of the chromium from the surface to produce the required porosity. After disassembly, the cylinders are finished by honing.

Mr Pyles concluded his paper with a report of a laboratory dust test on a small gasoline engine, which showed that cast-iron cylinders wore about four times as fast as chromium plated.

At the same session, Tracy C Jarrett, chief metallurgist, Koppers Co, American Hammered Piston Ring Division, told of experience with porous chromium plating on piston rings, a new development. This experience, he said, led to the following conclusions: (1) All surfaces to be plated should be honed first to remove all traces of turning, (2) for rings up to a nominal diameter of 6⅛ in., plate thickness, including porosity, should be 0.004 to 0.006 in., (3) thickness of porosity should be 0.001 to 0.0015 in., (4) profilometer readings in micro-inches RMS should be 45 to 90, measured at right angles to side faces, (5) hardness measured on the hard chromium surface, expressed in Knoop hardness numbers (100-gram load) should not be less than 775, (6) porosity should be created by reverse current, and (7) rings should be subjected to boiling water for one hour to remove possible traces of hydrogen.

Dr Jarrett pointed out that the plate is deposited directly on the OD surface of the ring and that after plating, the edges where the OD surface joins the side faces are rounded with a slight radius. At present, only one chromium-plated ring is used in aircraft engines and two in diesel engines, being installed in the top grooves. The porous OD surface permits the ring to carry oil for immediate seating purposes and at the same time permits the ring to wear quickly and produce its own mating surface for the particular barrel. The porous surface tends to bring the cast-iron rings in the lower grooves to a faster seat than if a non-porous chromium-plated or plain cast-iron ring were used, and to do it with less wear.

Field experience shows, Dr Jarrett said, that no feathering has occurred when a porous chromium ring is used in the top groove. When engines operate under sand or dust conditions, the porous-chromium-plated surface prevents wear from the dust and sand and reduces the amount of abrasive material contacting the remaining cast-iron rings. Not only does the plated ring appear to resist a greater part of the wear, permitting the other rings to register longer life, but it also reduces barrel wear considerably. Data from engines operating under abnormal dust conditions supported these statements.

Other papers presented at the conference are summarized below:

Diesel Maintenance in the Navy, *by Commander Thomas G Reamy, Bureau of Ships, USN.*

Shows the growth of diesel engines in naval service, and outlines the normal and emergency conditions which make maintenance of engines in naval service different and more difficult than ashore. Cites Navy methods of planning maintenance and accounting for it, giving some figures on peace- and wartime maintenance costs. Points out that difference in service conditions makes comparison with maintenance costs in other fields misleading. Outlines problems involved in planning for and stocking replacement parts and steps being taken to improve operations. Discusses responsibility of diesel industry with respect to conservative engine ratings and need for trained service personnel at key points.

Proposed Expressions for Root's Supercharger Design and Efficiencies, *by F A Hiersch, University of Michigan, Ann Arbor, Mich.*

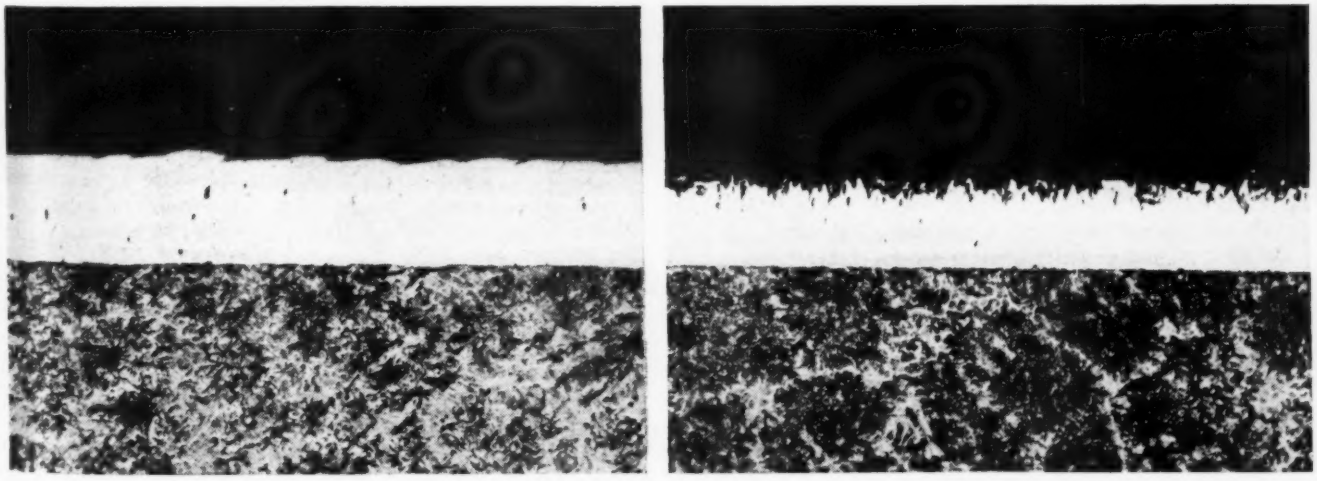
Defines certain proposed positive-displacement-blower efficiencies in terms of slippage air, which is taken as a means for rating the design of the blower. Examples show application of the method to specific problems.

Investigation of Large Diesel-Engine Wristpins, Pistons, and Crankcase Explosions, *by F E Faast, Consulting Engineer, Tampa, Fla.*

Gives results of research undertaken to solve wristpin and piston difficulties in large diesels which had experienced crankcase explosions. Precise measurements on a slotted-end wristpin showed that large wristpin deflections in fixed-end wristpins can cause excessive bearing pressures and temperatures, rupture of oil film, and large skirt deflections, all of which form explosion hazards and may cause piston-skirt rupture.

Rational Analysis of Stress and Strain in Connecting Rods, *by Otto R Spies, Analytical Engineer, Diesel Division, Baldwin Locomotive Works, Phila., Pa.*

An attempt to represent, in a systematic form, the consecutive stages of a rational analysis of stresses and strains in connecting rods. Includes a graphical determination of connecting-rod motion; analysis of gas forces, torque reaction, and kinetic reaction of rod itself; analysis of stresses and strains arising during assembly and under additional external and kinetic loading during engine operation; calculation of strain constant of rod bolts and measurement of bolt force during assembly; analysis of strain loading of crankpin eye during assembly; determination of forces acting on shank; analysis of conditions at wristpin end.



Cross-section (100x) of hard-chromium-plated cast-iron piston ring (left) and of porous-chromium-plated ring (right)

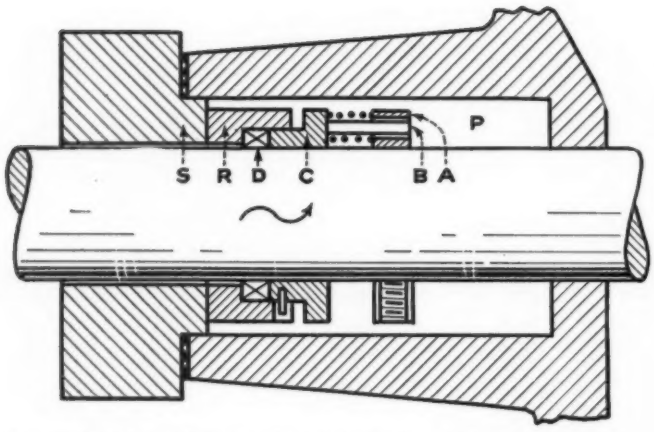


Fig. 2—Unbalanced mechanical seal, sealing surfaces between *R* and *S* prevents liquid leaking out of the pump

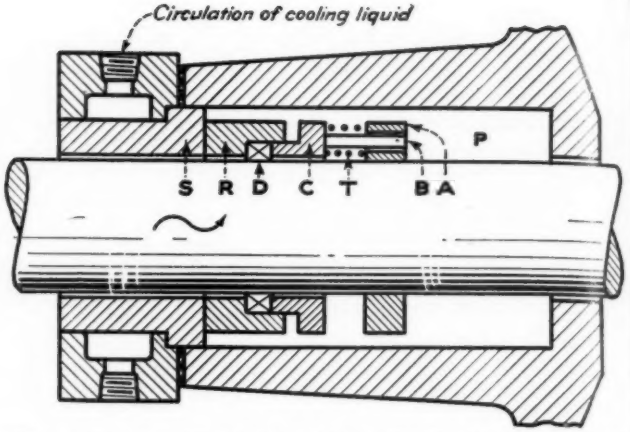


Fig. 3—Same as Fig. 2, but with cooling-liquid jacket around stationary part of seal to remove heat from sealing surfaces

Why Mechanical Seals Improve Centrifugal Pump Operation

H Hornschuck, engineer, Ingersoll-Rand Co, presents the how's and the why's of putting mechanical stuffing-box seals to good use on centrifugal pumps, and outlines the conditions that must be satisfied for successful operation

► DURING RECENT YEARS mechanical stuffing-box seals for pumps have received considerable attention. Pump manufacturers still use them with caution because operating experience is somewhat limited. Field and laboratory experiences, however, are encouraging and the seals are here to stay, even though they have not developed to a stage where they are a cure-all for packing troubles.

Mechanical seals (*Stuffing-box* is dropped for convenience.) are usually an integral part of the pump, installed by the manufacturer and, on large units, tested before shipment. Then, when placing the pump in service and during normal operation, adjustments of its seals are not necessary. In fact, many mechanical seals are self adjusting. For example, coolant pumps on automotive engines have mechanical seals, as do other small circulating and coolant pumps and refrigerant compressors. In these applications, pressures and temperatures usually are comparatively low, but mechanical seals are used also where pressures, temperatures and liquid characteristics make operation difficult with packed stuffing boxes.

Seal Construction

All mechanical seals have a rotating seal face, *R*, and a stationary seal face, *S*, Fig. 2, held in sliding contact with each other under sufficient pressure to prevent excessive escape of liquid between them. Springs usually hold the seal surfaces in contact with a pressure greater than that existing at the eye of the first impeller inside the pump, as in chamber *P* around the seal.

It is this pressure, in chamber *P*, that the contact surfaces between parts *S* and *R* must seal against. *S* corresponds to the packing gland of a conventional stuffing box and is bolted to make a tight joint with the end of the stuffing box. Part *A* is fixed to the shaft and connects to the seal by pin *B*. Packing *D* forms a resilient connection between *R* and *C* and acts as a seal between the two and the shaft. These parts rotate with the shaft but are stationary relative to each other and, therefore, do not subject the packing to friction or wear.

Contact pressure between the sealing surfaces of *S* and *R* is the chief factor limiting the use of the mechanical seal, Fig. 2. Wear is excessive if this pressure is too great for (1) pump speed, (2) pressure, temperature and liquid characteristics, and (3) sealing-face materials. The force producing contact pressure on sealing surfaces between *S* and *R* represents the difference between the force holding these surfaces together and the separating force acting between them. Since provisions have not been made in the seal, Fig. 2, to balance these forces, we call it an unbalanced type. Contact pressure on this type of seal is from 0.45 to 0.5 times the differential pressure against which the seal has to operate.

Unbalanced Seals

All seals on small equipment, such as coolant, automobile-cooling-water and small merchandising pumps are in general the unbalanced type, with a working pressure limited to about 40 psi on water. The seal member may obtain resiliency from rubber or metal bellows or specially designed soft seal rings, instead of from packing.

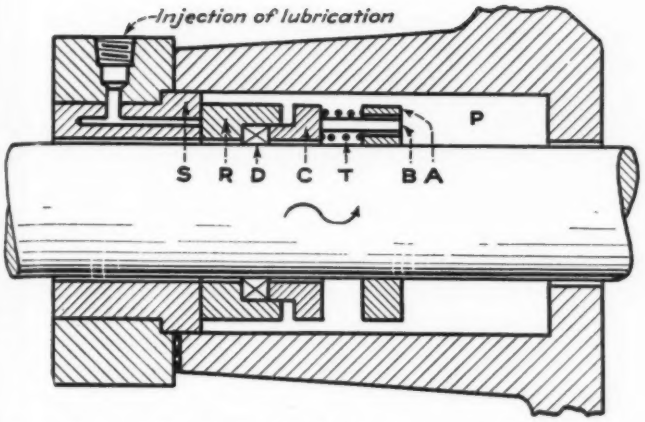


Fig. 4—Same as Fig. 2, but with lubrication connection to sealing surfaces between *S* and *R* to reduce wear on these parts

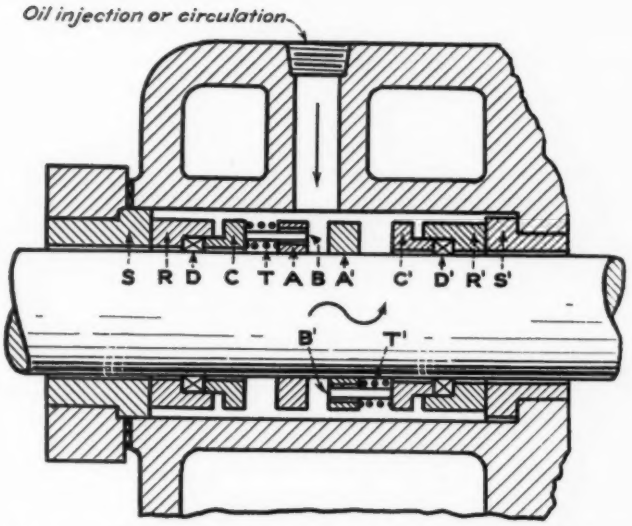


Fig. 5—Unbalanced double mechanical seal; sealing surfaces between *S* and *R* and *S'* and *R'* used on high-pressure pumps

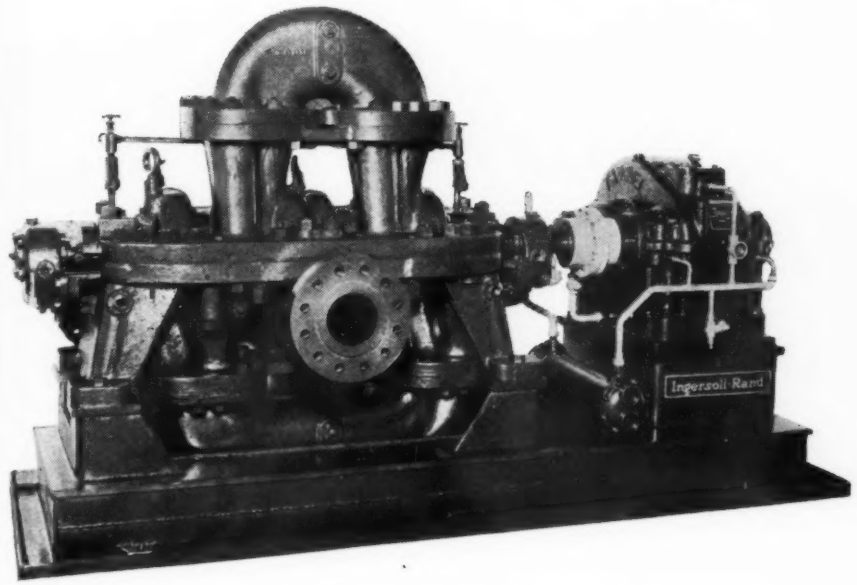


Fig. 1—This oil-pipeline centrifugal pump is equipped with mechanical seals and has high suction pressure for which the seals are designed to hold against

Just as for packing, seal manufacturers have certain maximum limits for pressure, speed and liquids, with friction the limiting factor. With seals, this problem can be dealt with somewhat more easily than with packing because many material combinations for the seal faces are possible, especially with recent developments in non-metallic bearing materials.

Lubricate Sealing Surfaces

Seal faces must be lubricated to reduce friction and to dissipate some of the heat generated. Normal leakage of several drops per minute through the seal is usually sufficient for lubrication. When pressures are high or liquids volatile, you may have to provide other means for lubrication or cooling. Heat can be easily carried away from the sealing faces by water circulation around the stationary face, as in Fig. 3. When contact pressure reaches a magnitude where lubrication from the liquid handled is not sufficient, oil lubrication is used for the stationary seal face, Fig. 4.

Fig. 5 shows the commonest arrangement for high pressures, hot oil, light hydrocarbons or oils containing acids. Two seals are used, one sealing toward the inside of the pump, the other toward the bearing end. A pressure approximately 10 to 20 psi higher than the stuffing-box pressure is applied to the space between the seals, and oil is either injected or circulated through this space. Both seals, therefore, operate in oil to keep them lubricated and cooled.

While this arrangement presents a solution to many stuffing-box problems, it has the disadvantage of requiring auxiliary equipment for oil injection, such as a pump, pressure regulator, oil tank and piping. Furthermore, a small amount of oil flows continuously into the liquid pumped, which, besides the loss of oil, is objectionable for many applications. In addition to the three arrangements, Fig. 3 to 5, combinations of these and other auxiliary means have been used.

A reduction in contact pressure between the sealing surfaces would make it feasible to operate seals at correspondingly higher suction pressures and under less favorable lubricating conditions. This has been done by partially balancing the forces acting on the sealing faces; that is, in Fig. 6, sealing-surface area *B* has been made larger than area *A* which is subjected to full stuffing-box pressure. This type, called a "balanced seal," has been successfully operated in numerous applications for many years.

Balanced Seals

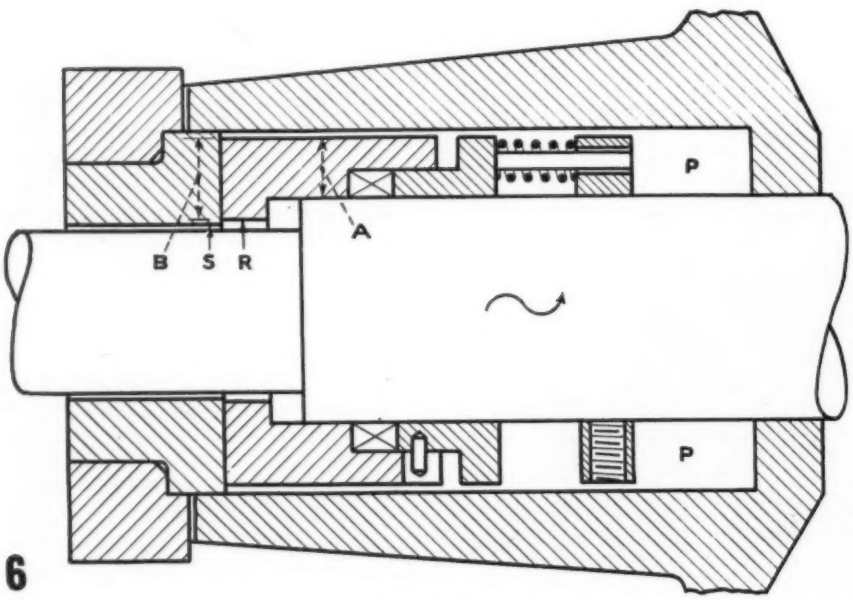
Theoretically, a balanced seal could be designed to have all forces balanced and, therefore, no contact pressure. Such a condition would exist if the sealing surface area equaled approximately twice the area subjected to the suction pressure. But practically, this condition is not feasible because of small imperfections on the sealing sur-

faces, variations in machining tolerances, imperfect alignment and vibrations in the pump shaft.

As a result, seals of this type are only partially balanced, but the unbalance is reduced to a point where it can be easily taken care of on the sealing surfaces. Successful operation can readily be obtained when contact pressure is less than one-half that of an unbalanced seal under the same operating conditions. Therefore, maximum application limit for a balanced seal should be twice that for an unbalanced seal. This is particularly pertinent when you handle liquids with poor or no lubricating qualities.

Single balanced seals have been in operation for some time, sealing hydrocarbons having a specific gravity of approximately 0.5 at suction pressures of several hundred pounds per square inch without any lubrication other than the small leakage across the sealing faces. In general, seals for this type of service are equipped with shallow auxiliary stuffing boxes using packing, the space between packing and seal being connected to a torch line or piped to atmosphere outside the pump house, as in Fig. 7. Any vapor escaping between the seal faces is properly vented to a place where it can do no harm.

On a properly functioning seal of either balanced or unbalanced type, leakage is very small—in many cases only a few drops a minute. Two main factors governing the amount of leakage are finish of sealing faces and shaft vibration. A seal with lapped or superfinished sealing faces operates successfully with less leakage than one with surfaces trued by grinding only. Offhand, especially on balanced seals, it might seem that an increase in contact pressure would lead to reduction in leakage. In my opinion, however, this can be true only when the increased load helps overcome physical imperfections of the sealing surfaces. Experimentally, it can be shown that on a stationary seal with practically perfect faces no change in leakage occurs unless the state of practically perfect balance is reached or exceeded.



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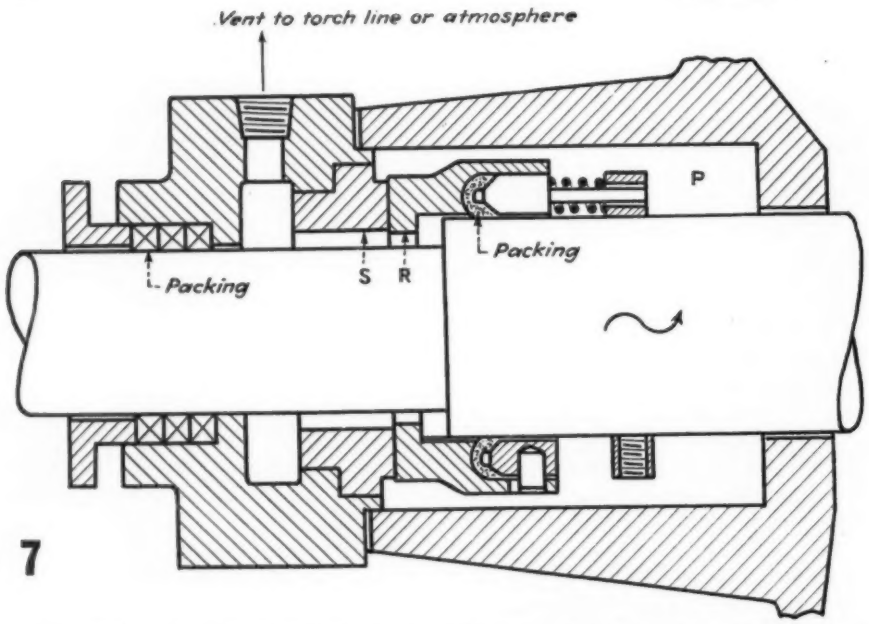

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Fig. 6—Balanced mechanical seal. Difference in areas *B* and *A* puts in close balance the total pressure tending to separate *S* and *R* and that hold them together. Fig. 7—Mechanical seal for hydrocarbons, arranged with auxiliary stuffing box

Light Hydrocarbons

In handling light hydrocarbons, leakage vaporizes when it reaches atmospheric pressure. When the vapor expands to gas, the refrigeration effect may freeze any moisture present to ice particles. If they form on the sealing faces, leakage increases and makes the seal inoperative. Heating the stuffing box with steam has overcome this.

Power required to operate a mechanical seal is less than that required to operate a packed stuffing box. This power is mainly a function of contact pressure and coefficient of friction. Assume three stuffing boxes: one packed, another with unbalanced seal and the third with balanced seal—all operating under the same conditions. Also, assume the same coefficient of friction for all three and the contact pressure for the packed box to equal stuffing-box pressure. Then, if the power for the packed box is unity, that for an unbalanced seal is approximately 0.5 and for a balanced seal, approximately 0.25.

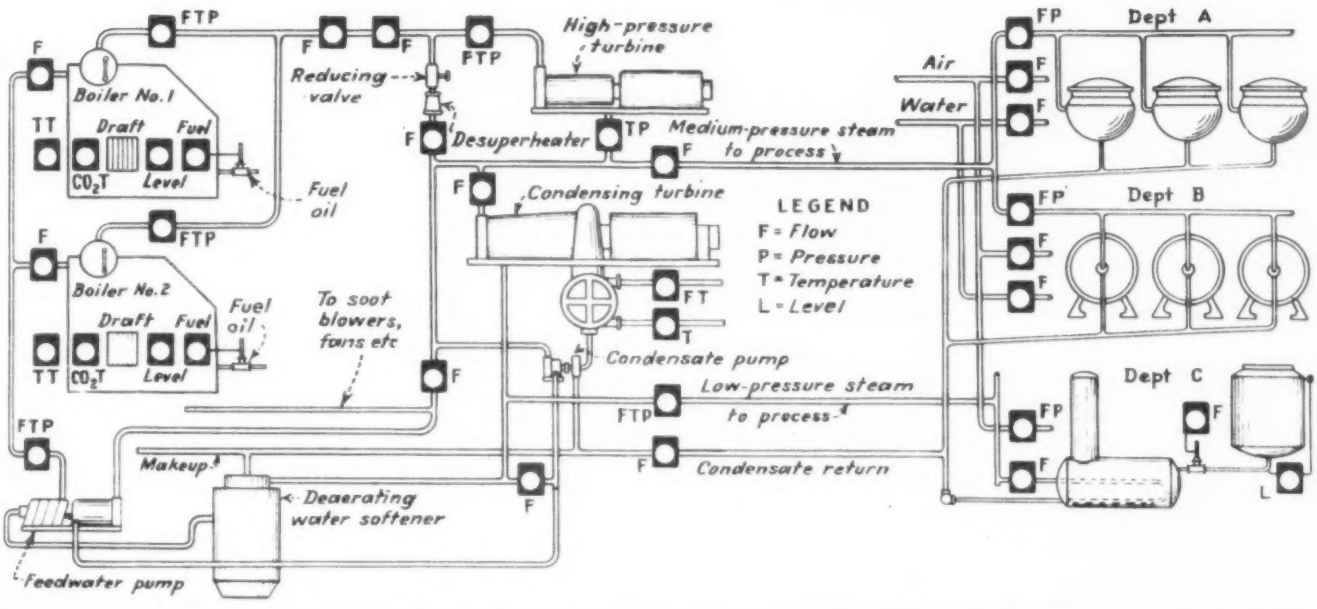
Starting Torque Required

The same relationship applies to the starting torque of these devices, since here again the controlling factors are contact pressure and coefficient of friction. The latter being many times greater when the shaft is at rest, starting torque for all three types of seals may reach such magnitudes with high suction pressures that it must be taken into consideration, particularly for units having small horsepower drivers.

With the exception of small pumps, mechanical seals are installed in the stuffing boxes originally provided for packing. As a rule, mechanical seals require less space than packing. Their full advantage is, therefore, not realized until they are made an integral part of pump design, which results in shorter shaft spans and, in many cases, elimination of shaft sleeves and their fastening devices.

HOW TO KEEP FLOWMETERS ACCURATE

By WILLIAM C BENNETT
Cochrane Corporation



Meter Accuracy Check List

ACCURACY IN FLOWMETERS is not something you can purchase and then forget about. It depends not only on obtaining good metering equipment, but also on installing it properly and maintaining it intelligently.

You can defeat accuracy in the final measurement at any one of many places in the metering system even though measurements at all other places are correct. The 44 items listed below may seem like a formidable number to affect flowmeter accuracy. Usually, however, in any given installation only one or two of the many possible sources of inaccuracy are the cause of incorrect readings. As a guide to installation and operating engineers, this check list will prove useful because it covers every make and type of head flowmeter.

Causes of Errors in Meter Readings

I – WHEN CREATING DIFFERENTIAL PRESSURE BY THE PRIMARY ELEMENT, AVOID THESE MISTAKES:

A – Computing primary element with insufficient data or incorrect pipe diameter.

B – Locating primary element too close to flow disturbance or to pulsations.

C – Installing primary element reversed, or eccentrically, with orifice obstructed or drainhole in wrong location.

D – Permitting primary element to become dirty, drainhole to become plugged, orifice edges rounded, orifice obstructed or plate buckled.

II – WHEN TRANSMITTING DIFFERENTIAL PRESSURE, AVOID THESE MISTAKES:

A – (1) Making pressure taps with nipples projecting into pipe, nipple holes burred or too small. (2) Placing pressure taps in wrong location.

B – When connecting pressure taps to meter piping: condensate reservoirs too small, not level, or insulated.

C – In connecting piping to manometer: wrong or insufficient pitch in connecting lines, liquid not same density in both lines, lines too small in diameter, too long, leaking, clogged.

III – WHEN MEASURING DIFFERENTIAL PRESSURE IN THE METER, AVOID THESE MISTAKES:

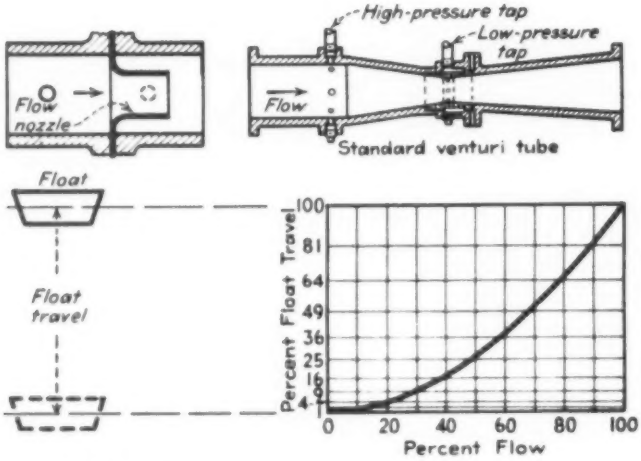
A – In installing manometer: not level, with differential-pressure connections reversed, no settling chambers, or atmospheric temperature too high or too low.

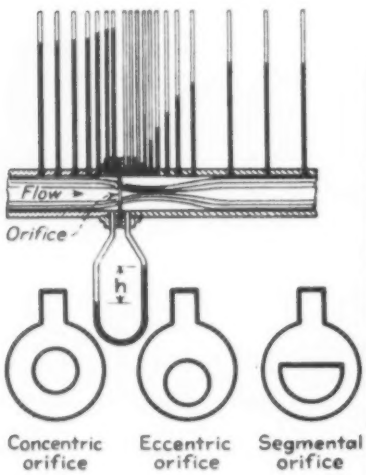
B – In maintaining manometer: dirty or incorrect volume of mercury, condensate in manometer for gas or air, gas or air in manometer for steam or liquid.

C – In transcribing the record: wrong chart, pen out of arc, excessive friction and recording chart out of time.

Take care of flowmeter accuracy and it will take care of the efficiency and economy of your boiler room, turbine room and process departments. Flowmeters now in use cannot be replaced for the duration and few additional ones can be obtained. If you haven't an instrument man, place your flowmeters and other instruments under your best maintenance man's care, supplemented by regular inspection visits from the manufacturer's representative.

I—CREATING DIFFERENTIAL PRESSURE BY THE PRIMARY ELEMENT





A — Mistakes in Computing Primary Element

1 — Incorrect or insufficient data

REMEDY: Obtain complete data listed below.

REQUIRED INSTALLATION DATA FOR ALL SERVICES

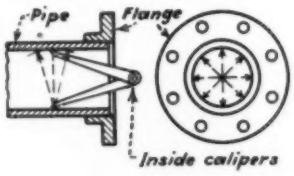
Maximum flow to be metered; pressure; temperature; nominal pipe size and series; actual internal pipe diameter and type of taps to be used.

For steam: superheat or percent moisture. For liquids other than water: specific gravity and viscosity at flow temperature. For gas: base pressure, usually 14.4 psia; base temperature, usually 60 F; specific gravity (air=1); quality and barometer.

2 — Inside pipe diameter reported incorrectly

REMEDY: Measure inside pipe diameter as described below.

Use internal calipers and a steel rule and measure inside diameter at four equally spaced locations at both upstream and downstream taps. Average these eight dimensions.



B — Mistakes in Locating Primary Element

3 — Located too close to flow disturbances

REMEDY: Chart below gives minimum lengths of straight pipe, in pipe diameters, upstream and downstream from concentric orifice plates or flow nozzles when flange or vena-contracta taps are used. Straight-run requirements become less as ratio of orifice diameter d to inside pipe diameter D decreases. For example, in case 1, when the ratio of $d:D=0.4$, upstream straight run of pipe should be not less than six pipe diameters with or without straightening vanes, but when the ratio of $d:D=0.7$, the upstream straight run of pipe must be not less than 13.5 pipe diameter without straightening vanes, and not less than eight pipe diameters when straightening vanes are used. Straightening vanes are helpful, except in case 2, where their value is doubtful, and in case 3.

Fitting Before Straight Run	Piping Layout†	Straightening Vanes	For Flange or Vena-Contracta Taps* Upstream Minimum A (in Pipe Diameters) When Orifice Ratio d:D= 0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
1. Elbow, tee or a cross	A, B, Orifice location	None	6	6	6	6	7	9	13.5	20
		With	6	6	6	6	6.2	7	8	10
2. Two ells or two bends in same plane	A, B	None	8.5	8.5	8.5	8.5	10	13.5	18.5	25
		With	8.5	8.5	8.5	8.5	9	10.3	12.5	15.5
3. Reducer	A, B	None	6	6	6	6.2	7.5	9.5	12	15.3
4. Two ells or two bends at right angles	A, B, Orifice location	None	14	14.5	16	18	20.7	24.6	31	40
		With	9.5	9.5	9.5	9.5	10	11	13.2	16.5
5. Globe or regulating valve††	A, B, Valve	None	16	17.5	19.3	22	25	30	38.5	50
		With	9.2	9.2	9.2	9.5	10.5	12.3	15.2	19
			Downstream Minimum B (Pipe Diameters) For All Cases							
			2.3	2.6	3	3.3	3.6	4	4.3	4.6

*For pipe taps increase A two diameters and B eight diameters.

†Single long-radius bend is equivalent to straight run of pipe.
††Wide-open gate valve is equivalent to straight run of pipe.

STRAIGHTENING VANES

Select vanes of a length not less than ten times greatest dimension of individual vane passage.

4 — Located too near a source of pulsations

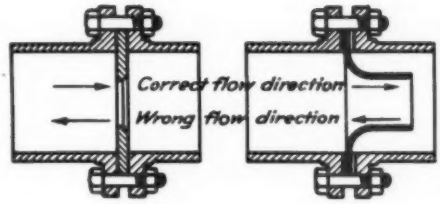
REMEDY: Place orifice far enough away from source of pulsation. If this is impossible, install an air chamber for liquids. Install combination of capacities and throttling orifices for steam or air. Check elimination of pulsations with an engine indicator.

Pulsation effects are reduced by use of a large orifice and pipe ratio, $d:D$, and a high-pressure differential. This combination usually requires reducing the pipe size. Sometimes you can correct meter readings by a pulsation factor, based on analysis of the pulsation cycle.

C — Mistakes in Installing Primary Element

5 — Installed backwards

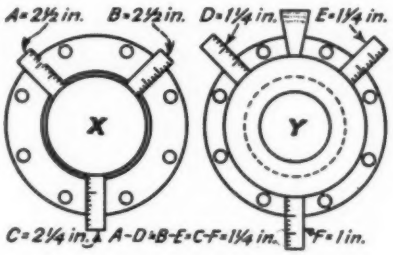
REMEDY: Reverse, and make sure also that location of upstream and downstream connections are not reversed (See item 17.).



6 — Installed eccentrically

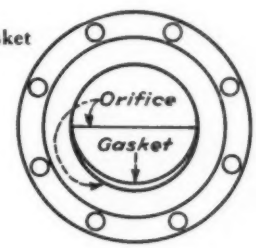
REMEDY: Center as indicated in sketch. Notch or file outside edge of orifice plate, if bolts interfere.

To center the orifice, the most convenient measuring point is the outside circumference of the pipe flange, but this is often eccentric with respect to the internal circumference of the pipe. To check this possible error, take three equally spaced measurements between inside of pipe and outside of flange, as at *X*. Then insert orifice plate and make another set of measurements at the same locations between the outer edge of the orifice plate and outside of the flange, as at *Y*. Shift the orifice plate until the *difference* between the two sets of measurements for each of the three locations is the same. In the figures $A - D = B - E = C - F$. The orifice plate will then be centered with the inside circumference of the pipe.



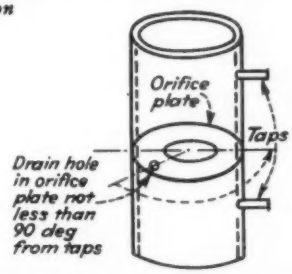
7 — Eccentric- or segmental-orifice bore obstructed at bottom by gasket (See figure at right.)

REMEDY: Recut and relocate the gasket



8 — Drainhole in orifice plate located less than 90 deg from pressure taps on vertical installation

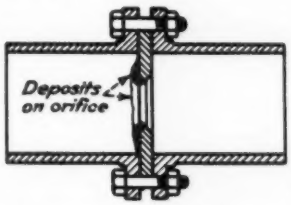
REMEDY: Revolve plate so that drainhole is at least 90 deg from taps, as at right.



D — Mistakes in Maintaining Primary Element

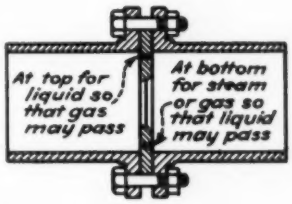
9 — Dirt or scale collection on orifice plate, as at right

REMEDY: Clean plate more frequently. Be careful of sharp edge of orifice when cleaning. Do not scrape.



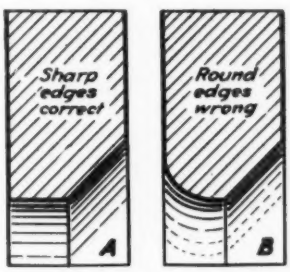
10 — Drainhole in orifice plate, shown at right, plugged by dirt or obstructed by gasket

REMEDY: Remove obstruction.



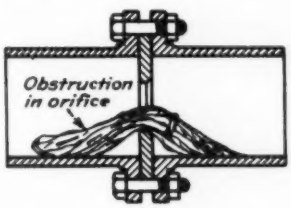
11 — Dull, rounded edge on orifice plate as at B, below

REMEDY: Replace plate with one that has a sharp-edged orifice, as at *A*. If plate is not beveled downstream, reverse it so as to secure new, sharp upstream edge.



12 — Obstruction lodged in orifice bore (Overalls, lunch boxes, welding rods, tools, etc, have been found.)

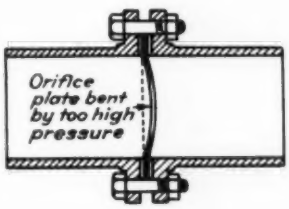
REMEDY: Remove obstruction.



13 — Warped or buckled orifice plate causing low reading (Usually plate is concaved because it is too thin for pipe size and pressure.)

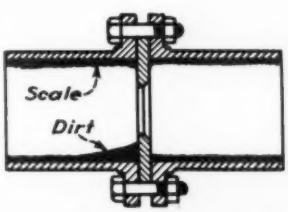
REMEDY: Flatten, and back up with dead plate.

Recommended plate thicknesses are: 1/16 in., up to 4-in. inside pipe diameter; ⅛ in., 5- to 14-in. pipe; 3/16 in., 16- to 18-in. pipe; ¼ in., 20- to 24-in. pipe; and ⅜ in., 30-in. pipe and over.

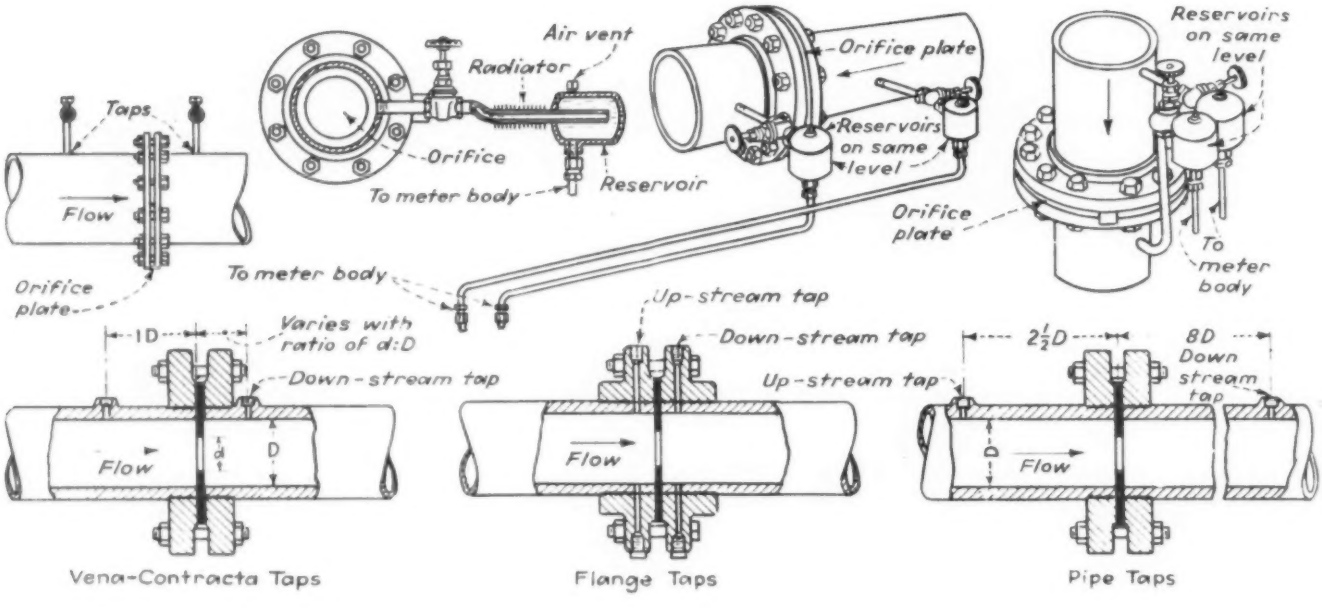


14 — Sediment or scale built up in layer on inside pipe wall, causing a decrease in flow area

REMEDY: Clean the pipe.



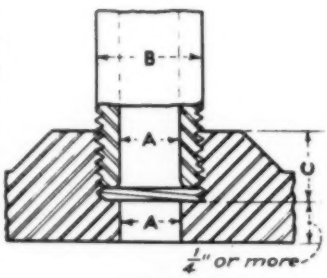
II—TRANSMITTING DIFFERENTIAL PRESSURE

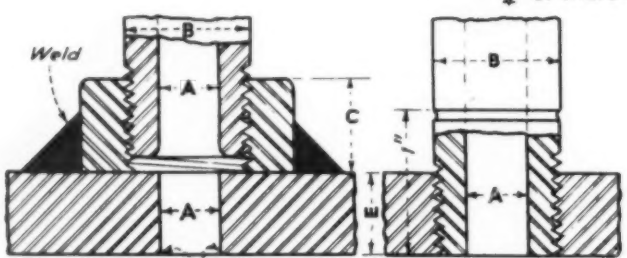


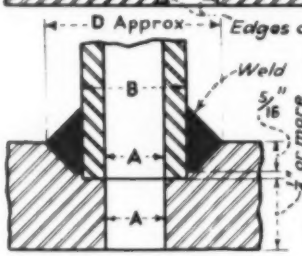
A—Mistakes in Making Pressure Taps

15—Pressure nipples project into pipe beyond inside edge of hole; inside edge of hole in pipe burred; welding of boss or coupling caused a projection into pipe

REMEDY: Correct by reinstalling as shown in instructions at right and below.







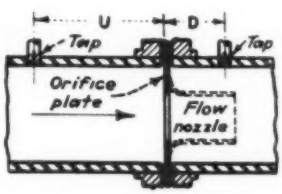
Nipple Size, In	A In.	B In.	C In.	D In.	E In.
3/8	7/16	11/16	1/2	1 7/16	3/8
1/2	7/16	7/8	9/16	1 5/8	1/2
3/4	5/8	1 1/16	11/16	1 13/16	1/2
1	13/16	1 5/16	13/16	2 1/16	9/16

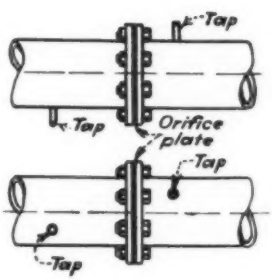
16—Hole diameter of pressure nipple too small, causing slow drainage or even capillary action

REMEDY: Change to meet recommendations in chart above and as follows: Use ½-in. nipples (7/16-in. holes) up to 900 psi and 750 F. Use ¾-in. nipples (⅝-in. holes) for bent nipples and on top of pipe following bend in horizontal plane. Use 1-in. nipples (13/16-in. holes) moly-steel welded to pipe above 900 psi and 750 F.

17—Upstream and downstream measurement reversed or inaccurately laid out

REMEDY: Should be within 1/32 in. for vena-contracta taps and within ½ in. for pipe taps. Flange taps are 1 in. from orifice face to center line of tap. Both *U* (upstream) and *D* (downstream) taps at right are measured from upstream face of orifice plate or flow nozzle.



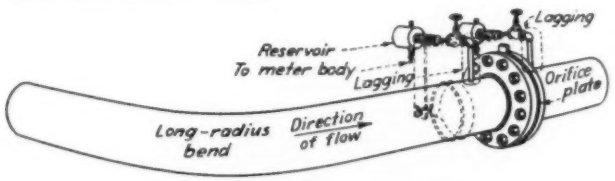


18—Pressure connections not on same side of pipe or not in same plane, as at right

REMEDY: Change to correct location.

19—Subjected to swirling flow because connections are made in the normal location in the side of pipe after a long-radius bend

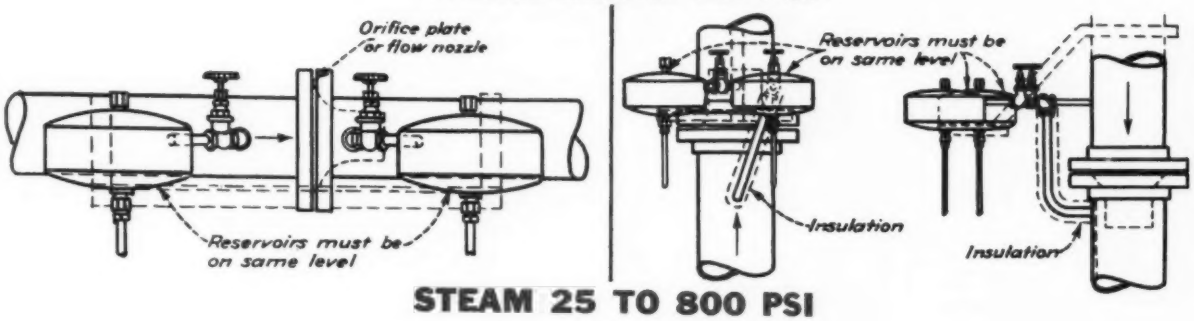
REMEDY: Make connections at right angles to plane of long-radius bend, as shown below.



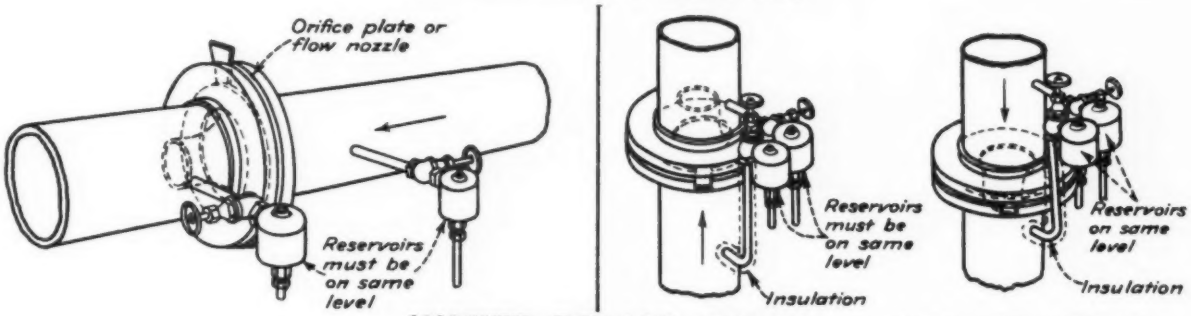
INSTALLING THE PRIMARY ELEMENT

In Horizontal Pipe | **In Vertical Pipe**

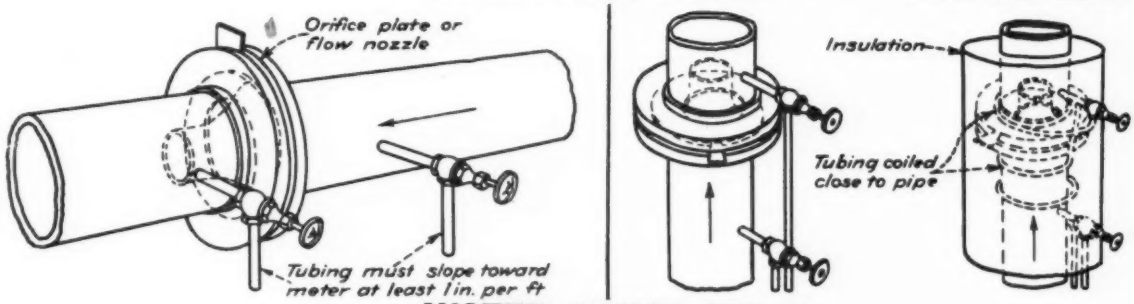
STEAM BELOW 25 PSI



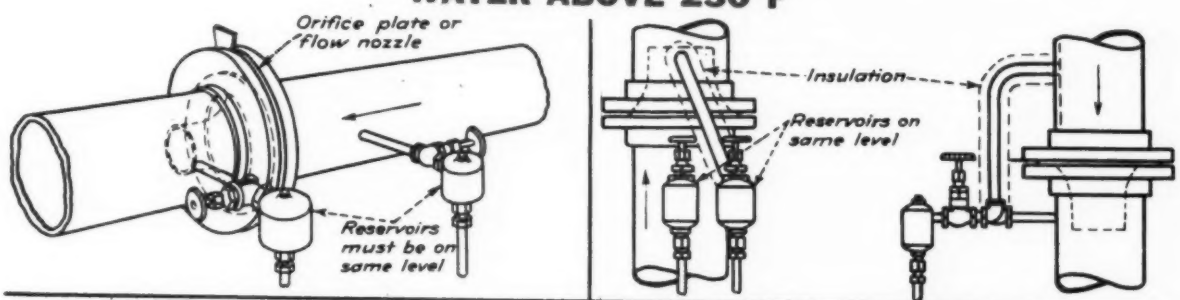
STEAM 25 TO 800 PSI



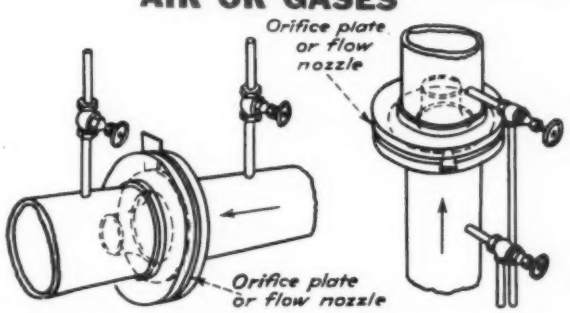
WATER BELOW 125 F — 125 TO 250 F



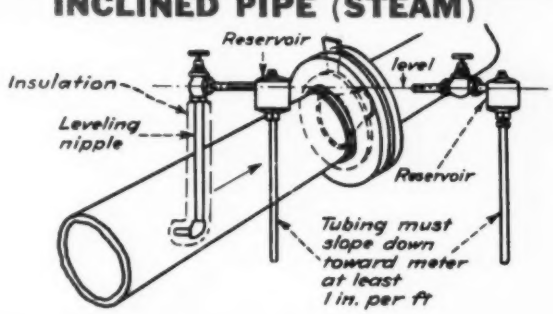
WATER ABOVE 250 F



AIR OR GASES

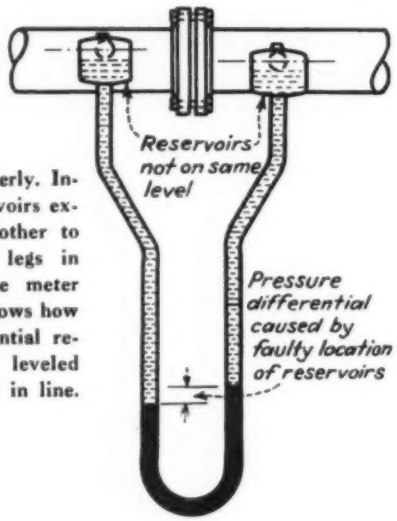


INCLINED PIPE (STEAM)



B — Mistakes Between Pressure Taps and Connecting Piping (Reservoirs and Valves)

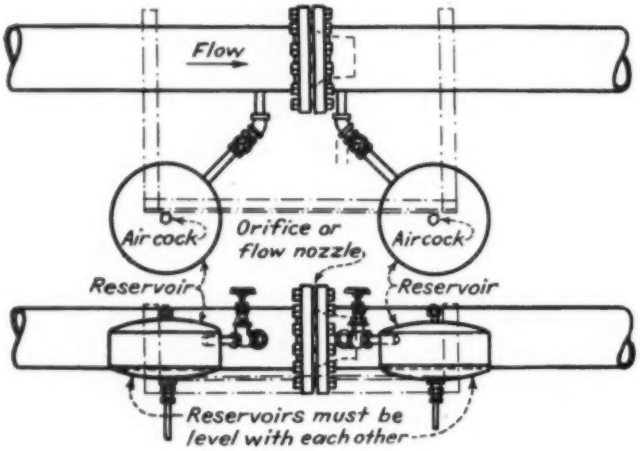
20 — Condensation reservoirs not level with each other, as at right, or individually level



REMEDY: Level properly. Install condensation reservoirs exactly level with each other to maintain equal water legs in each connection to the meter body. Figure on right shows how a false pressure differential results from improperly leveled reservoirs with no flow in line.

21 — Condensation reservoirs not large enough for low-pressure steam (below 25 psi) to insure quick return toward zero when steam flow is cut off

REMEDY: Install large reservoirs as below.



22 — Condensation reservoirs partially or wholly insulated

REMEDY: Remove insulation.

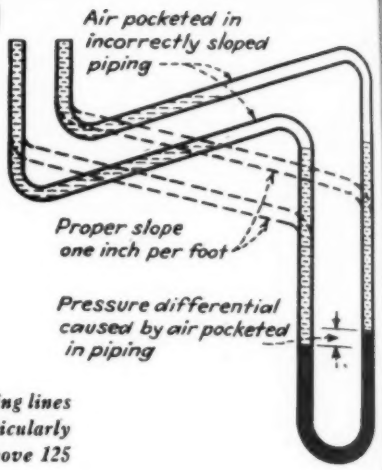
C — Errors in Connecting Piping to Manometer

23 — Connecting lines pitched in wrong direction

REMEDY: Reinstall. Arrange pressure piping to prevent air pockets forming and causing a false pressure differential when metering steam or water; and condensation pockets forming when metering gas or air. See that horizontal runs of piping slope downward at least 1 in. per ft toward the meter (See No. 24).

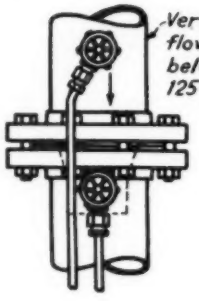
24 — Connecting lines insufficiently pitched

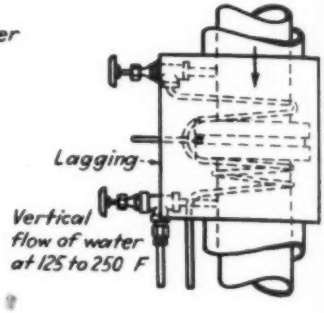
REMEDY: Reinstall lines with horizontal sections pitched downward 1 in. per ft toward the meter, as indicated at right.


Air pocketed in incorrectly sloped piping
Proper slope one inch per foot
Pressure differential caused by air pocketed in piping

25 — Liquid in connecting lines not at same density, particularly when measuring water above 125 F in vertical lines

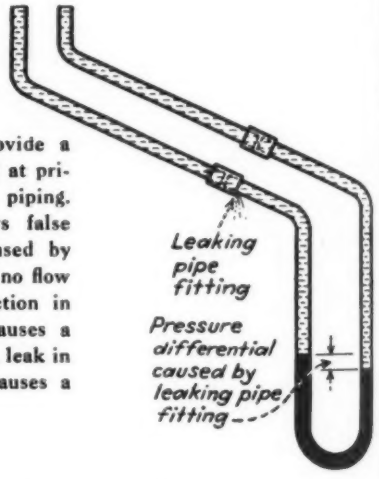
REMEDY: Equalize temperature in both legs, as at lower right.





26 — Connecting lines leak

REMEDY: Tighten as necessary. Pressure lines must be tight. Use smallest possible number of fittings. Cut clean, long threads. Provide a union at manometer and at primary element ends of piping. Diagram at right shows false pressure differential caused by leaky pipe coupling with no flow in line. A leaky connection in the low-pressure line causes a high meter reading and a leak in the high-pressure line causes a low reading



27 — Connecting lines to manometer too small in diameter

REMEDY: Use ½-in. copper or steel tubing or ½-in. iron pipe up to 50 ft. Above 50 ft. use next larger size. Do not use copper tubing above 600 psi and 750 F.

28 — Connecting lines too long

REMEDY: Relocate manometer or use electric meter.

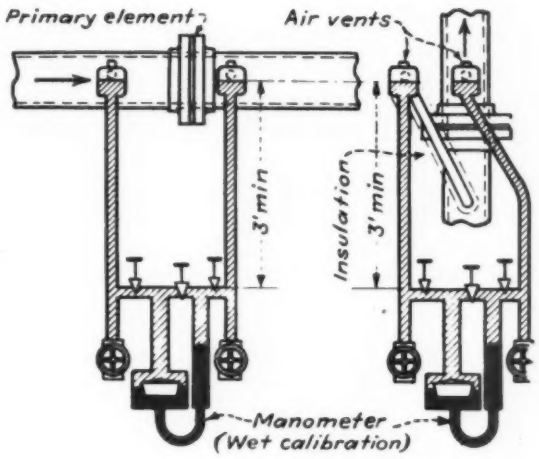
29 — Connecting lines clogged, meter sluggish

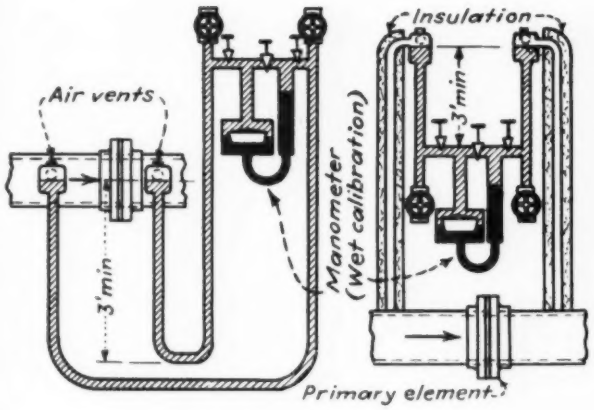
REMEDY: Blow out pressure piping at regular intervals. Clean pressure connections at orifice by removing orifice-valve stems and running wire through connections.

PIPING FOR METER INSTALLATIONS

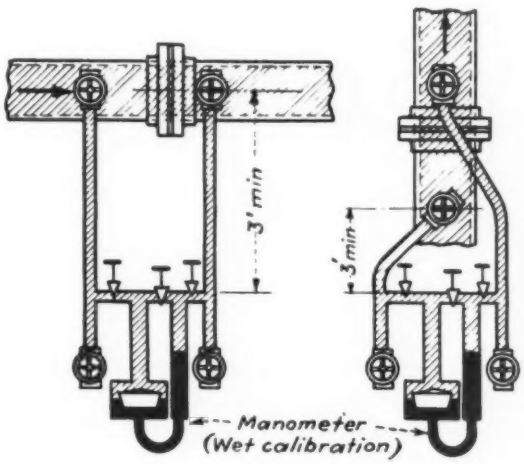
Meter Below Primary Element | **Meter Above Primary Element**

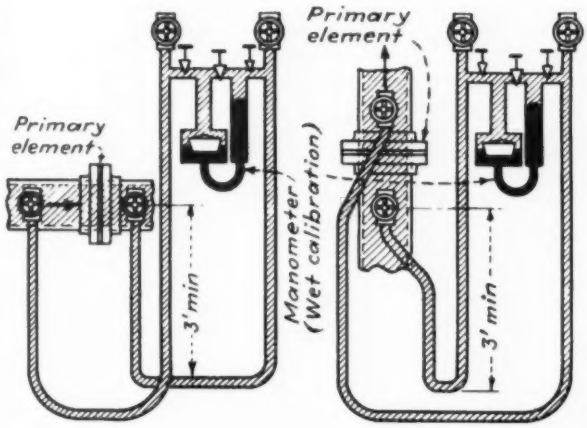
STEAM



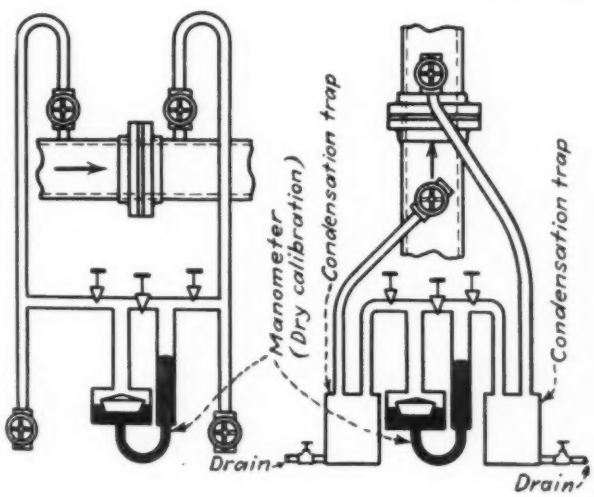


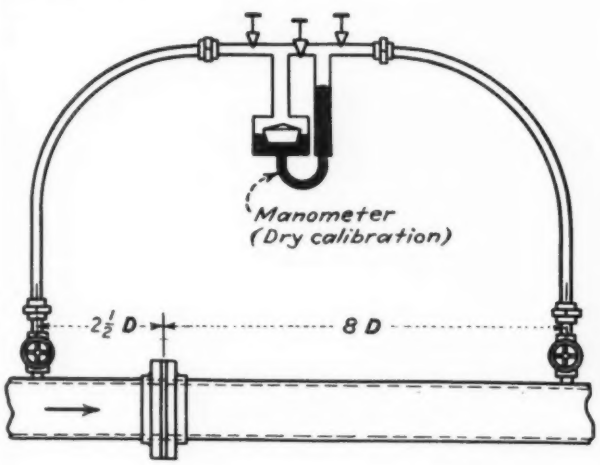
WATER





AIR OR GASES

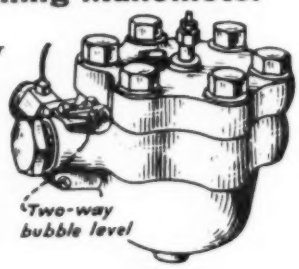




III—MEASURING DIFFERENTIAL PRESSURE

A—Mistakes in Installing Manometer

30—Failure to level manometer

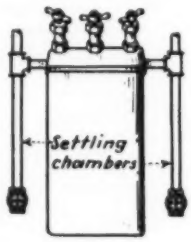


REMEDY: Apply bubble level to float chamber of manometer, from front to back and from side to side. Some meters have self-contained plumb bob or small two-way bubble level, as at right.

31—High- and low-pressure connections reversed

REMEDY: Check carefully; reverse if necessary. High-pre sure manometer leg (sometimes marked *H* or +) connects to upstream tap. Low-pressure manometer leg (sometimes marked *L* or —) connects to downstream tap.

32—Settling chambers omitted for blowing down on steam or water measurements



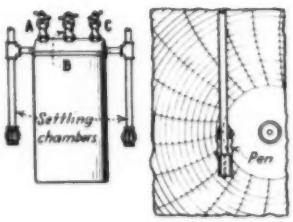
REMEDY: Install settling chambers as indicated at right. Two tees, two long nipples and two valves make up this effective blowdown arrangement.

33—Manometer subjected to temperature extremes

REMEDY: Relocate or, if that is impossible, shield against high temperature; for low temperature, enclose meter, including manometer, and provide heating element.

B—Mistakes in Maintaining Manometer

34—Failure to zero meter

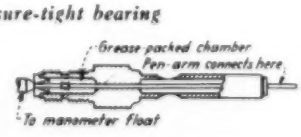


REMEDY: Meter should be zeroed at operating line pressure. First be sure to open equalizing valve *B*, then close valve *C* in low-pressure leg, leaving valve *A* open in high-pressure leg. Pen should come to zero on chart.

35—Leaky equalizing valve

REMEDY: Check equalizing valve for leaks. With pen recording flow and equalizing valve *B* above closed, close valves *A* and *C* in high- and low-pressure legs. If equalizing valve leaks, pen will move.

36—Failure to lubricate pressure-tight bearing

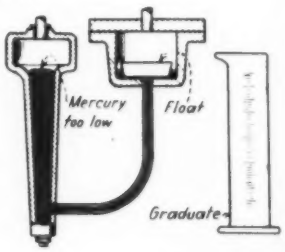


REMEDY: Apply proper lubricant according to meter manufacturer's instructions.

37—Dirty mercury, especially on electrical meters, operated by a change in circuit resistance

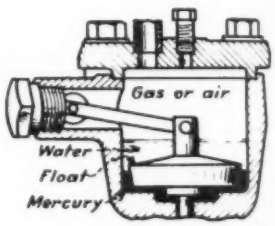
REMEDY: Drain mercury from manometer, clean it and refill with purified mercury. Mercury may be cleaned (1) by placing in a container and agitating with compressed air issuing from the end of a tube extending down in the mercury to bottom of container, (2) by filtering through chamois skin or cheesecloth, (3) by washing in a 5 to 10% solution of nitric acid and water, being careful to remove the last trace of acid by washing the mercury with water. Before attempting to clean mercury, obtain instructions from meter manufacturer.

38—Incorrect volume of mercury, especially where manometer has one chamber shaped for square-root extraction



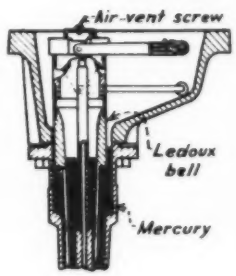
REMEDY: Drain out mercury and measure in graduate, as shown at right.

39—Condensate in manometer when measuring gas or air



REMEDY: Drain out water and mercury, clean manometer and replace mercury.

40—Air in manometer when measuring steam or liquids



REMEDY: Remove according to meter manufacturer's instructions. Manometers of Ledoux-bell design have small screw at top of bell, as at right, to remove air from the bell.

C—Mistakes in Translating the Record

41—Wrong chart or incorrect multiplying factor

REMEDY: Rubber stamp each chart with name of service, location, and correct multiplier.

42—Pen out of arc on time line

REMEDY: Adjust pen arm length.

43—Excessive friction in recording, indicating or integrating mechanism. Excessive friction of pen or pen pivots

REMEDY: Correct according to manufacturer's instructions.

44—Recording chart out of time because: (1) Mechanical clock requires fast or slow adjustment. (2) Electric clock is subject to fluctuating or incorrect frequency. (3) Chart hub is not tight

REMEDY: Correct as required by conditions.

Practical suggestions for creating emergency capacity . . . substitutes for hard-to-get parts and materials . . . cures for overloads, breakdowns . . . ways to build up short-handed staffs. Share your ideas! Send in your rough notes and photos or sketches. Payment at regular rates

WARTIME POWER CLINIC

OLD MOTOR BUS ENGINES PUMP WATER

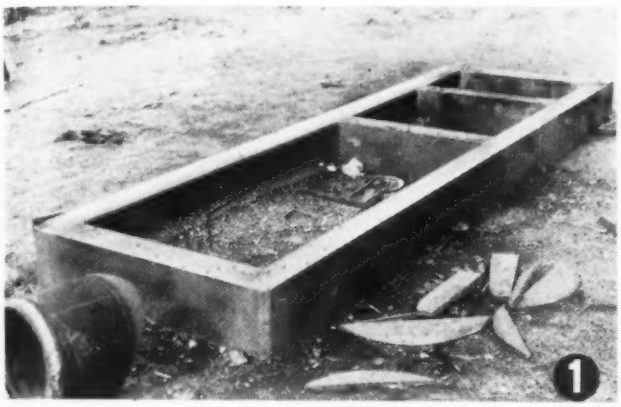


Fig. 1—Engine and pump foundation, all welded by the plant welder from steel channels, was later set in concrete

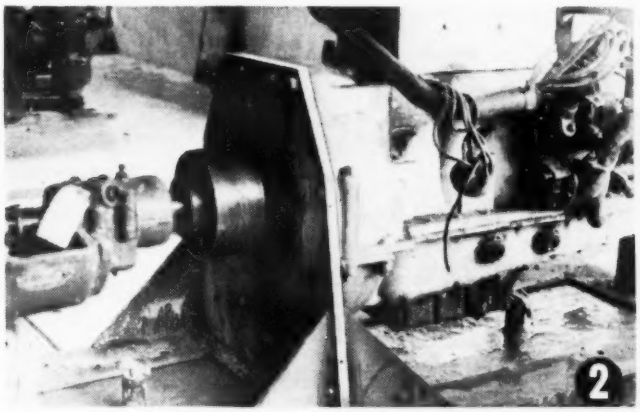


Fig. 2—Vertical, reinforced steel plate, bolted to engine flywheel bell, supports engine in line with pump coupling

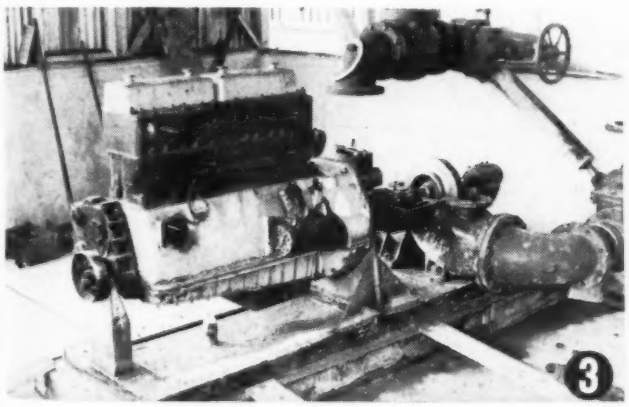


Fig. 3—Engine mounted on base, made of welded steel channels, grouted to concrete foundation

Fig. 4—Water-jacketed exhaust manifolds, in units of three cylinders, showing bolting provisions

A LARGE INDUSTRIAL gasoline company recently enlarged its facilities to produce more butane and other products from natural gas. This in turn required circulating more water over the louver tower to maintain proper cooling.

Circulating pumps in the original plant were driven by industrial gas/gasoline engines of conventional type, so the management wished to use the same plentiful fuels to power the new pumps. Since duplicates of the original engines were not obtainable, the engineers bought four secondhand truck and motor-bus engines from salvage yards. No two were exactly alike; each required special supports. However, each engine drove an identical centrifugal pump with similar driving connections. Conventional cast-iron bases were unobtainable, but structural steel bases served as well—perhaps better.

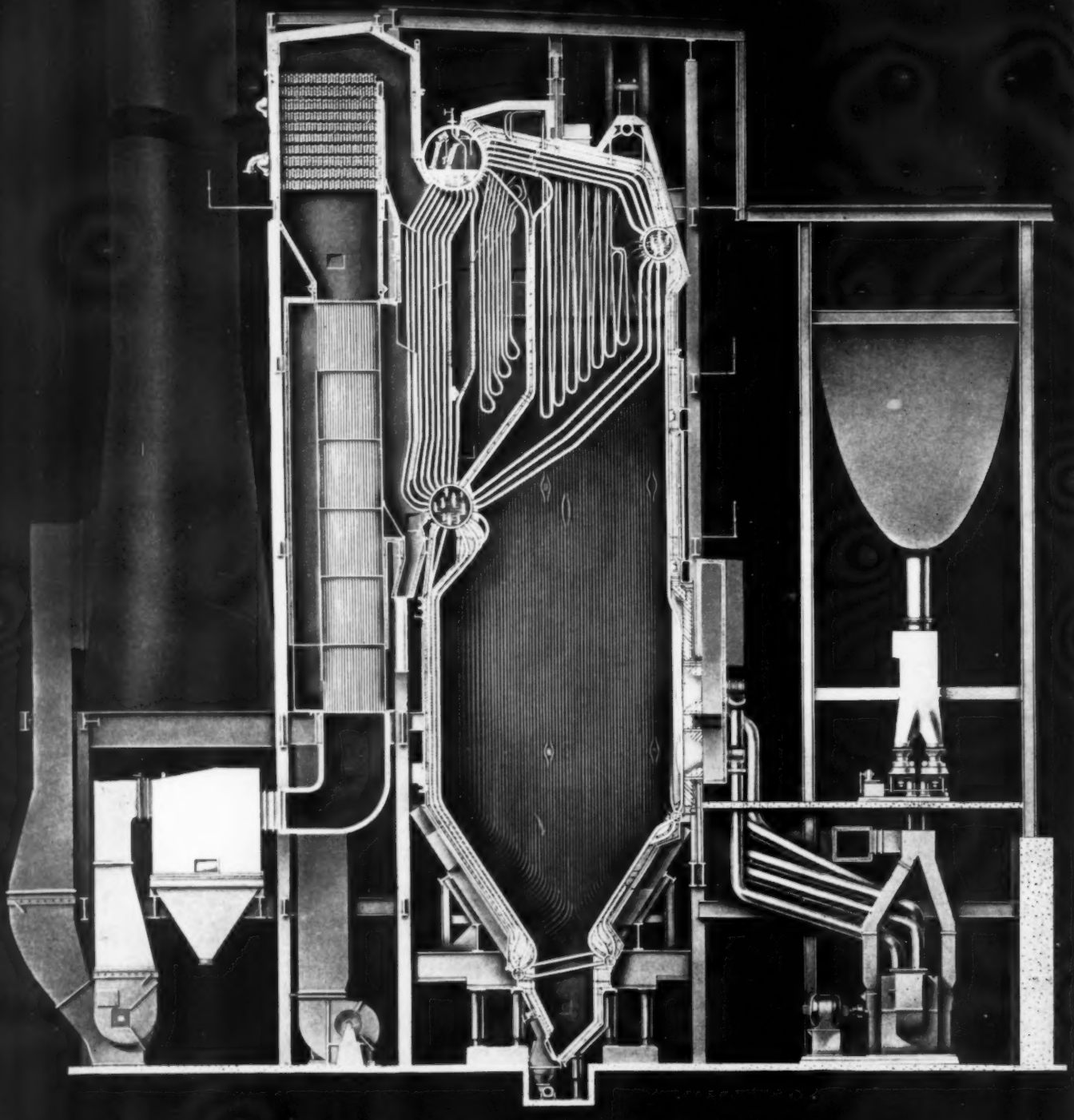
The plant welder mitered sections of wide channel iron and welded them into a rigid foundation, Fig. 1, large enough to support the engine and its pump. All units were direct connected, so clutch plates, shafts and transmissions were discarded.

To support the engine's driving end, a heavy steel plate was trimmed to the contour of the flywheel bell housing and drilled to match the centering dowel pins and capscrew holes (Fig. 2). Skirt of the sheet was trimmed to line the crankshaft with the flexible coupling and pump shaft.

Toughest job was the stubshaft, specially tailored to connect each engine to its coupling flange. Welded to one end of the stubshaft was a circular plate fitted into the recess of the flywheel around the original clutchshaft pilot bushing. This was first drilled to receive the original flywheel-to-crankshaft bolts. To insure a drive free from misalignment and vibration, this stub-

CONTINUED ON PAGE 98

Typical Recent Riley Central



Carolina Public Utility, Cape Fear Station, N. C.

330,000 lbs./hr. - Press. 1025 lbs. Temp. 905° F. Efficiency - 87.2% Riley Unit

Furnace Length—20′6″
Furnace Width—22′6″
Furnace Height—36′9″
Furnace Volume—16,600 cu. ft.
Heat Release—22,700 B.T.U.

Heating Surfaces
Boiler—11,060 sq. ft.
Water Walls—10,590 sq. ft.
Economizer—7,220 sq. ft.
Air Heater—36,000 sq. ft.

Units Fired by 3 No. 5 Duplex Riley Pulverizers and 6 Riley Burners

It will pay you to visit modern Riley Installations

Station Steam Generating Units

A few typical Riley installations

PUBLIC UTILITIES

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Carolina Power & Light Co.

City of Los Angeles, Calif.

Penn. Edison Co.

Iowa-Illinois Gas & Electric Co.

Commonwealth & Southern Corp.

Southern Ind. Gas & Electric Co.

Central Illinois Light Co.

Florida Power & Light Co.

STEEL INDUSTRY

Carnegie-Illinois Steel Corp.

Republic Steel Corp.

Colorado Fuel & Iron Co.

Wisconsin Steel Corp.

Wheeling Steel Corporation

OIL INDUSTRY

Standard Oil Co. of N. J.

Standard Oil Co. of Indiana

Standard Oil Co. of California

Standard Oil Co. of Louisiana

Shell Oil Company

Humble Oil & Refining Co.

CHEMICAL INDUSTRY

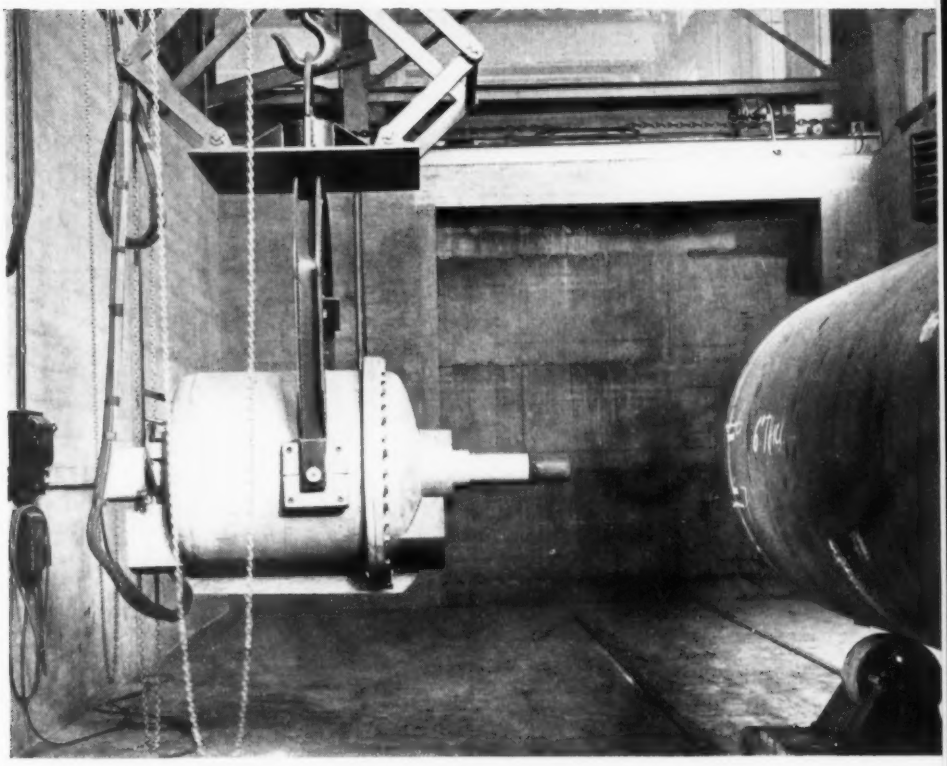
Carbide & Carbon Chemical Co.

Dow Magnesium Corp.

Celanese Corp. of America

Calco Chemical Division

Riley uses 1,000,000 volt X-ray to examine drum welds



Riley 1,000,000 Volt X-ray Room
One of the largest in the country

Through the installation of 1,000,000 volt X-ray equipment, the largest and most modern of industrial X-ray apparatus, Riley further assures users of Riley Boiler equipment of the highest quality of workmanship. Fabrication of Riley equipment is also speeded up. In a little more than a minute this X-ray giant will radiograph a 4" thick weld—speeding up the process about 30 times over the use of 400,000 volt equipment, the previously most advanced industrial X-ray.

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CONTINUED FROM PAGE 95

shaft fitting required extremely accurate welding and drilling.

When the engineers were ready to connect the engine to the pump, they set both units on the form with the pump in place and the engine resting loosely on the foundation, supported only by the heavy steel plates and stiffening gussets. After the two units had been definitely aligned, they welded the engine supports directly to the channel-iron base.

The original exhaust manifolds were of conventional design and unsuitable for a plant where the metal might come in touch with inflammable materials. The engineers constructed water-cooled manifolds in units of three cylinders each, two units per engine, arranged to be attached to the motor block (Fig. 4 and 5) by the original crowsfeet and retaining studs. Water passes into the main sections of the manifolds, upwards through the pipe jacket.

The usual engine radiator system was discarded because jacket water is furnished by the plant circulating system. Combination gas/gasoline carburetors allow the engines to use either natural gas or liquid fuel. The original starters and generators remain on the engines and each unit is equipped with storage batteries for starting the ignition.

While these makeshift drives are by no means equivalent to engines built for stationary service, they must continue to run for the duration, with the aid of close operating attention and occasional replacements of wearing parts.

Santa Monica, Calif. J C ALBRIGHT

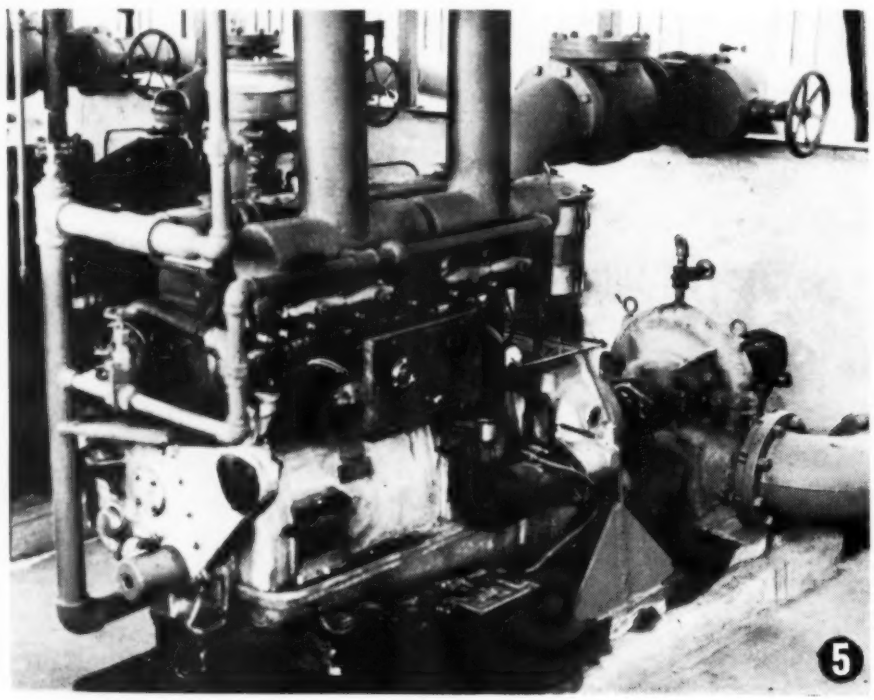


Fig. 5—Completed unit ready to pump water

Groove Prevents Flange Distortion

SEVERAL COLUMNS of our new alcohol installation were equipped with home-made vacuum-breaker valves of the type shown. In their original form, the flanges were plain, as shown at the left. A persistent leakage of vapor forced us to overhaul the valves, but they leaked again as soon as they were put back in service.

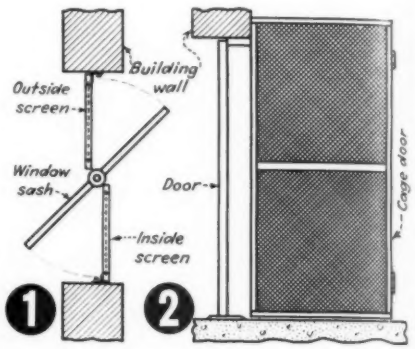
Finally, we realized that distortion was the source of our trouble. Note from the sketch that the flange bolts have to be set up heavily to make a tight joint against the uneven flanged ends of the copper risers, flared and hammered by a coppersmith. Even our experienced pipe fitters were unable to make these joints tight without so distorting the flanges that the valve rings would not seat properly.

To remedy the difficulty, we machined an annular groove in each flange, as shown at the right. The improved flexibility absorbed the distortion resulting from bolt tightening, and prevented its transmission to the area of the valves in contact with the disks. The valves are now leakproof.

Philadelphia, Pa. EMIL WITTMAN

Wartime Door and Window Screens

WE HAD THE PROBLEM of protecting the windows and doors of our plant against the entrance of unauthorized persons and at the same time keep it easy for those on legitimate business to gain access through the door. This was done by building a large cage around the inside of the door, as in Fig. 2. The cage we build of heavy wire mesh, such as used to inclose backs of switchboards, about 6-in. larger than the door

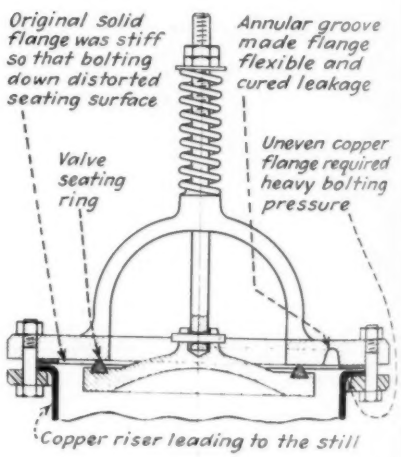


and securely bolted it to the wall around the door. A door in the cage can be unlocked only from inside the plant.

The plant door we arranged to ring an electric bell each time anyone opened it to enter the cage. One of the plant operators then looks him over. If he is known to the operator, he is admitted; if not, he is dealt with according to the situation.

We also screened the windows with the same material. The windows swing open around a horizontal axis. So that the screens could be permanently installed we made them in two sections, in top half of the window and the other half in the bottom, as in Fig. 1.

Fairview, N. J. M N GOZDENOVICH


Original solid flange was stiff so that bolting down distorted seating surface
Annular groove made flange flexible and cured leakage
Valve seating ring
Uneven copper flange required heavy bolting pressure
Copper riser leading to the still

Note (above) groove cut for flexibility to cure distortion and resulting leakage

A Direct Calculation of Gas Pressure Drop in Pipes

Figure isothermal gas-flow pressure drop in horizontal lines by assuming the fluid to be a liquid, and then correcting it by a factor taken from a simple curve

By A S HALL, Jr, *Instructor in Mechanical Engineering*, and R C BINDER, *Associate Professor of Mechanical Engineering, Purdue University*

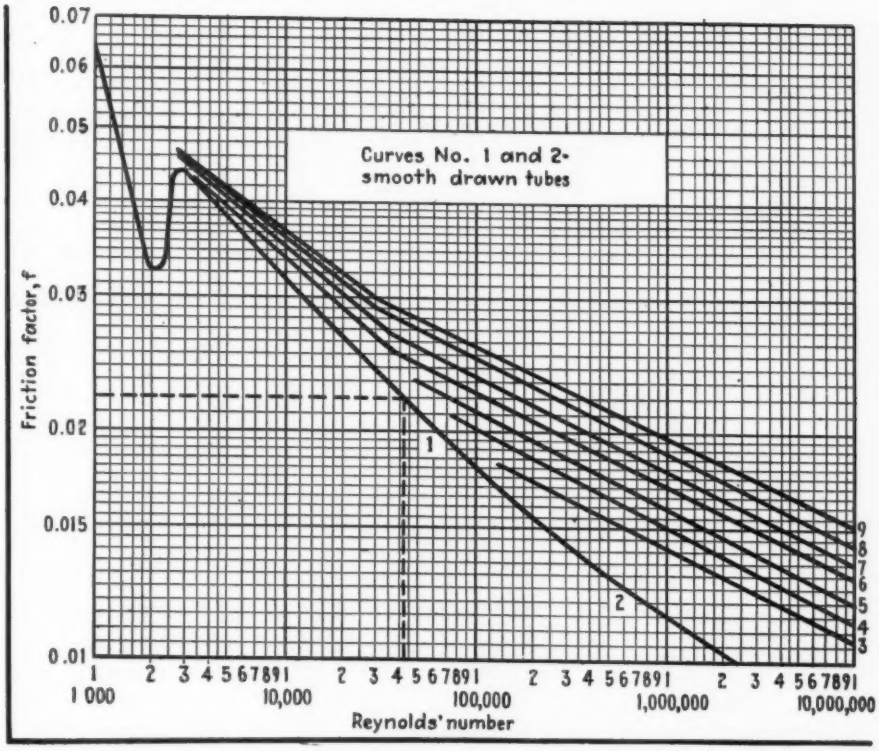


Fig. 1—Pipe friction relation to Reynolds' number for pipes of different material. Curve numbers refer to various pipe sizes and materials shown in Table II

▶COMPUTING PRESSURE DROP in a constant diameter pipe carrying a liquid is a familiar problem and easily solved. The corresponding problem for a gas, however, is much more difficult, being complicated by the varying specific volume, and hence the varying velocity of fluid flow. To simplify gas flow problems, use the expression for a liquid, and then modify it by a suitable correction factor to give the correct result for gas. The following explanation shows how to do this for the flow of a gas at constant temperature with negligible change in kinetic energy. A large proportion of practical problems, as those involving long pipes, fall into this class.

The familiar expression for pressure drop in a horizontal pipe carrying a liquid is:

$$p_1 - p_2 = f \frac{l}{d} \frac{V^2}{2gv} \qquad (1)$$

The pressure drop can be calculated if l, d, V, v and the viscosity of the liquid, μ, are known. Proceed by calculating the dimensionless ratio Reynolds' number, obtain the friction factor f from the

FOLLOW THESE STEPS

1. Compute Reynolds' number for the gas
2. Determine friction factor from Fig. 1
3. Use equation (3) to find B for liquid
4. Convert B (liquid) to B (gas) in Fig. 2
5. Multiply entrance pressure by B (gas) to find pressure drop

Table I
Explanation Of Symbols

- p_1 = absolute pressure at pipe entrance, lb per sq ft abs
- p_2 = absolute pressure at pipe exit, lb per sq ft abs
- l = length of pipe, ft
- d = diameter of pipe, ft
- V = velocity at entrance, fps
- v = specific volume at entrance, cu ft per lb
- g = gravitational acceleration, 32.2 ft per sec per sec
- μ = absolute or dynamic viscosity, lb-sec per sq ft
- f = pipe friction factor
- B = ratio of pressure drop to entrance pressure
- N_R = Reynolds' number

Table II

Use Curve No.	*Clean steel wrought iron, in.*	*Clean galvanized iron, in.*	*Best cast iron, cement, light riveted sheet ducts, in.*	*Average cast iron rough-formed concrete, in.*	*First-class brick, heavy riveted steel, in.*
3	14 – 42	30	48 – 96	96	220
4	6 – 12	10 – 24	20 – 48	42 – 96	84 – 204
5	4 – 5	6 – 8	12 – 16	24 – 36	48 – 72
6	2 – 3	3 – 5	5 – 10	10 – 20	20 – 42
7	1½	2½	3 – 4	6 – 8	16 – 18
8	1 – 1¼	1½ – 2	2 – 2½	4 – 5	10 – 14
9	¾	1¼	1½	3	8

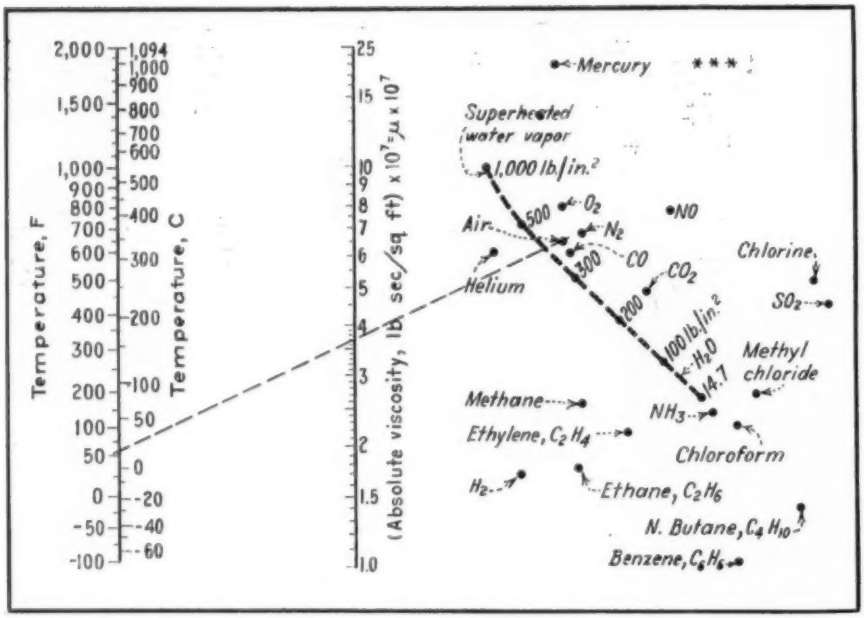


Fig. 3—Variation of absolute gas viscosity with temperature in lb-sec per square foot. Example: Find the absolute viscosity of air at 59 F. Find 59 F on the left-hand scale and draw a line from this point to the index point for air; at the intersection of this line with the viscosity line, read $\mu \times 10^7 = 3.7$; $\mu = 3.7 \times 10^{-7}$, or 0.00000037 lb-sec per sq ft

for liquid flow, and then referring to equation (4) or Fig. 2.

As an example of using the chart, consider the following problem: Compute the pressure drop in a horizontal 6-in. smooth pipe 10,000 ft long, carrying air. Flow is at a constant temperature of 59 F. Pressure and velocity at the entrance are 20 psi abs and 10 ft per sec, respectively. The specific volume $v = 9.6$ cu ft per lb.

(*Continued on page* 154)

chart*, Fig. 1, then use equation (1).

The corresponding expression for the flow of a gas at constant temperature in a horizontal pipe is**:

$$p_1^2 - p_2^2 = f\frac{l}{d}\frac{V^2 p_1}{gv} \qquad (2)$$

Rearranging the terms puts equations (1) and (2) in more directly comparable forms. Dividing equation (1) by p_1 gives the expression for liquid flow:

$$\frac{p_1 - p_2}{p_1} = \frac{flV^2}{2gdp_1v} = B \qquad (3)$$

Dividing equation (2) by p_1^2 and rearranging, gives the expression for gas flow:

$$\frac{p_1 - p_2}{p_1} = 1 - \sqrt{1 - \frac{flV^2}{gdp_1v}} = 1 - \sqrt{1 - 2B} \qquad (4)$$

Equations (3) and (4) can be compared for identical values of the factor B. It becomes apparent then that if B, the ratio of pressure drop to entrance pressure, is computed by the commonly used formula for liquids, then the correct value of this pressure drop ratio for a gas under the same entrance conditions is simply $1-\sqrt{1-2B}$.

Fig. 2 shows the pressure drop ratio for gas flow in relation to the pressure drop ratio for liquid flow. There is not much difference between the liquid and gas relations for values of $\frac{(p_1 - p_2)}{p_1}$ below 0.1. The difference becomes greater, however, at values of the pressure drop ratio above 0.1. For example, for a liquid value of $\frac{p_1 - p_2}{p_1} = 0.30$, the corresponding gas value of $\frac{(p_1 - p_2)}{p_1}$ is nearly 0.37. Determine the pressure drop for isothermal gas flow by first using the simple relation

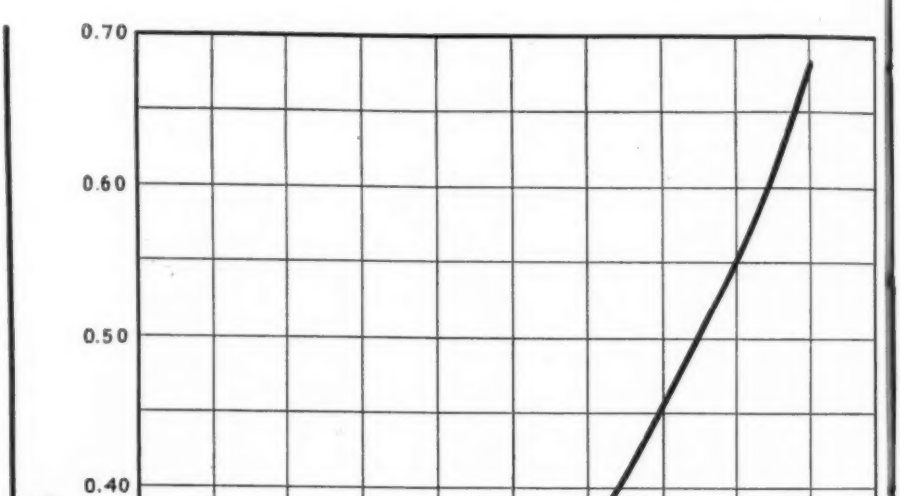


Fig. 2—Relation of pressure drop ratio for constant-temperature gas flow to pressure drop ratio for liquid flow in long horizontal lines. Follow dotted line

Is Your Turbine-Oil Care Good, Bad or Indifferent?

Let's look at good care—at an expert's rules for long-lived useful lubricating oil. Further hints by William G Forbes, Tidewater Associated Oil Co*, to keep circulating system charge in operation for the longest possible period

▶ MOST LIGHT-GRADE TURBINE OILS contain an inhibitor—an anti-oxidant that materially lengthens their useful life. Actual process of the inhibitor action is not definitely known, but certain materials possess the peculiar power, if present in only small quantities, of retarding the oxidation process.

The supply of inhibitor, only a fraction of a percent of the total quantity of oil, can, theoretically, be consumed in service but only under the most adverse conditions. The small amount of makeup oil normally added from time to time more than maintains the proper concentration of inhibitor.

Many chemical compounds possess inhibiting powers when blended with petroleum products. Choice depends on the experience of the individual refiner. Additives of this type are not soluble in water and are not removed by purification methods in common use. However, they are removed to an appreciable extent by filtering through clay or fuller's earth.

No Mystery

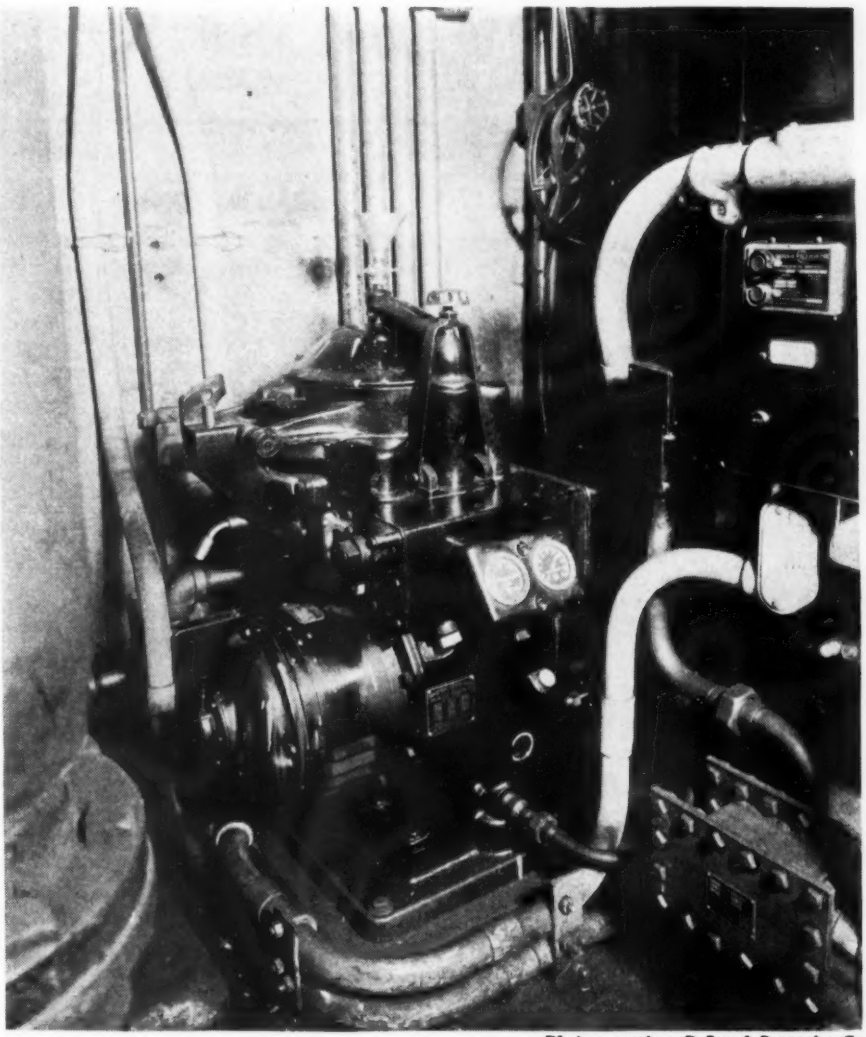
There is no mystery about inhibitors. The following items listed at random all retard oxidation of lubricating oil: nitrogen-hydrogen compounds, aromatic alcohols, phenols and certain complex metallic compounds. However, the amateur is advised not to try to improve on the refiners' research by adding an inhibitor of his own. Apart from complications that might arise, excess inhibitor over the amount found effective accomplishes no useful purpose.

So little inhibitor is needed that a research chemist has difficulty identifying which of several is present in a given oil sample. Contrary to a belief often expressed, there is no basis in fact that oil from one refinery cannot be mixed with another brand because of inhibitor differences.

Inhibitors are more effective in light oils than in heavier grades. The heavier the oil, the greater is the natural resistance to oxidation and breakdown. Inhibitors give light oils comparable staying power with heavier grades.

An anti-rust inhibitor is sometimes added to turbine oils, particularly for the initial charge of a new machine. New solvent-refined oils do not spread readily over the surface of water in a thin layer. Because of this lack of wetting ability, they tend to allow rusting in new units particularly if water enters the oil charge from sealing glands or other sources. Rusting, if present at all, usually occurs during the first few days of operation. Wetting power is imparted by such compounds as organic petroleum acid, stearic acid, caprylic acid, palmitic acid, caproic acid and others.

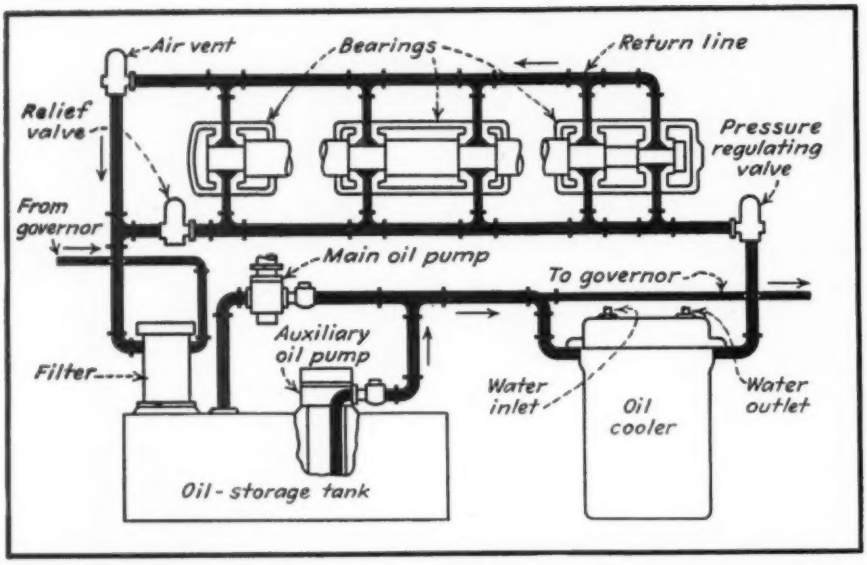
Elimination of sludge and water from



Photos, courtesy DeLaval Separator Co

Closeup of compact centrifuge for removing sludge and water from turbine oil charges. One centrifuge can serve many turbines if proper piping and tanks are provided

*Condensed from the author's forthcoming book "Lubrication of Industrial and Marine Machinery," John Wiley & Sons. All rights reserved.



Elements of turbine oiling system showing proper arrangement of pumps, filters, makeup and drain systems that provide for normal and emergency conditions

a turbine oiling system can be carried out in several ways. Sludge or oxidized oil is heavier than the remainder of the charge and settles in low, least agitated parts of the system. Not all broken-down molecules drop out easily; some remain in solution while the oil is warm but settle out as the oil cools and becomes motionless.

The centrifuge is a highly effective instrument for removing sludge and water. Better separation is obtained if the centrifuge is operated at less than full-rated volumetric capacity.

Cloth filter bags and steep cone-shaped settling tanks are often employed for sludge separation. Fuller's-earth filters are not recommended for oils that contain inhibitors since they tend to remove the additives.

Intermittent or continuous filtration, essentially a refining process, materially prolongs the life of an oil charge by removing small amounts of sludge formed from day to day. Any method or combination of methods that accomplishes this result is advantageous.

Another problem faced by turbine operators is the formation of an emulsion by seepage of water into the oiling system. Regular centrifuging aids in eliminating water and sludge from the oil charge, but in the event of formation of a persistent emulsion, the oil is unsuitable for further use and should be changed at the first opportunity. Heat is a valuable aid in breaking an emulsion, and a separate tank with steam coils to heat the oil charge to a temperature over 200 F is suggested.

Turbine oil-purification setup in a utility plant can transfer oil from circulating system to storage tanks, filters and centrifuges. Watch out for fire hazards

Foaming is generally brought about by sudden addition of too much new oil. Add fresh oil gradually to give the combining molecules a chance to stabilize themselves. Another cause of foaming is placing return lines too high above the receiving tank so that the waterfall effect aerates the oil. This condition, once recognized, can be readily remedied by preventing the splashing effect.

Turbine oiling systems contain from 50 to more than 2000 gal. Lubricating systems have reached a high degree of mechanical perfection and many run for years without more than annual routine cleaning of tanks, governor parts and coolers.

Bearing clearances are comparatively liberal to allow rapid heat removal by the oil. Coolers maintain low operating temperatures for the oil. Filters and centrifuges keep the oil in good condition. Successful turbine lubrication is due to these features.

In the absence of specific recommendations furnished by the turbine manufacturer as to grade of oil, standard viscosities for circulating systems run 150-200 SSU at 100 F for direct-connected turbines, and 300-400 SSU for single-reduction geared units. Ring-oiled bearings call for 150-300 SSU except when temperatures average above 180 F. High temperatures require 800-2000 SSU lubricants.

For New Machines

Clean a new turbine with a charge of inexpensive spindle oil, which should circulate through pipes and passages for two to three hours to remove any objectionable impurities. After draining this flushing charge, wipe oil tanks and all reasonably accessible parts with dry rags before installing the new oil.

This somewhat laborious procedure removes rust-protective compounds on turbine parts applied before shipment as well as metallic particles, etc.

For annual cleaning, dry rags do the best job for tanks, pipes, passages and mechanical parts. Carbon tetrachloride may be used on parts accessible on the floor or in open air. Under no circumstances should cleaning agents that might contaminate the oil charge be used on internal parts of the system.

Several compounds are marketed for removing deposits on oil-cooler tubes. Their manufacturers issue specific instructions for use. One usual formula is composed of half trisodium phosphate and half soda ash, mixed with hot water in the proportion of one part compound to five parts water. Strength of mixture and length of boiling depend on the persistence of deposits.

THE OPERATING ENGINEER

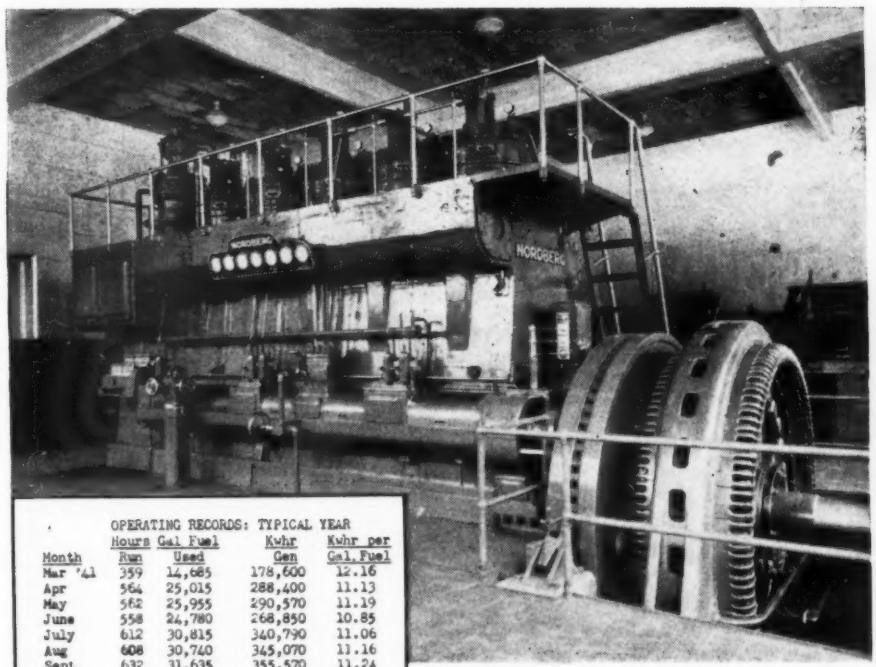
George Edwards *Advisory Editor*

PRACTICAL AIDS • MAINTENANCE HINTS • QUESTIONS — ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Three-Year-Old Diesel Takes 20,000 Hr of Trouble-Free Operation in Its Stride

Engineering skill planned a power system for one of Michigan's oldest millers, then followed through with intelligent maintenance, all of which adds up to 20,000 working hours to keep production rolling



OPERATING RECORDS: TYPICAL YEAR

Month	Hours Run	Gal Fuel Used	Kwhr Gen	Kwhr per Gal Fuel
Mar '42	359	14,685	178,600	12.16
Apr	564	25,015	288,400	11.13
May	562	25,955	290,570	11.19
June	558	24,780	268,850	10.85
July	612	30,815	340,790	11.06
Aug	608	30,740	345,070	11.16
Sept.	632	31,635	355,570	11.24
Oct	648	32,395	351,050	10.84
Nov	600	30,370	337,070	11.09
Dec	560	25,240	274,350	10.87
Jan '43	478	24,290	258,460	10.64
Feb	120	6,245	66,440	10.64
Total	**6301**	**302,185**	**3,353,330**	**11.1**

Fig. 1—This 1250-hp diesel engine has operated for 20,000 hr in three years and has generated 10,000,000 kwhr without an enforced shutdown

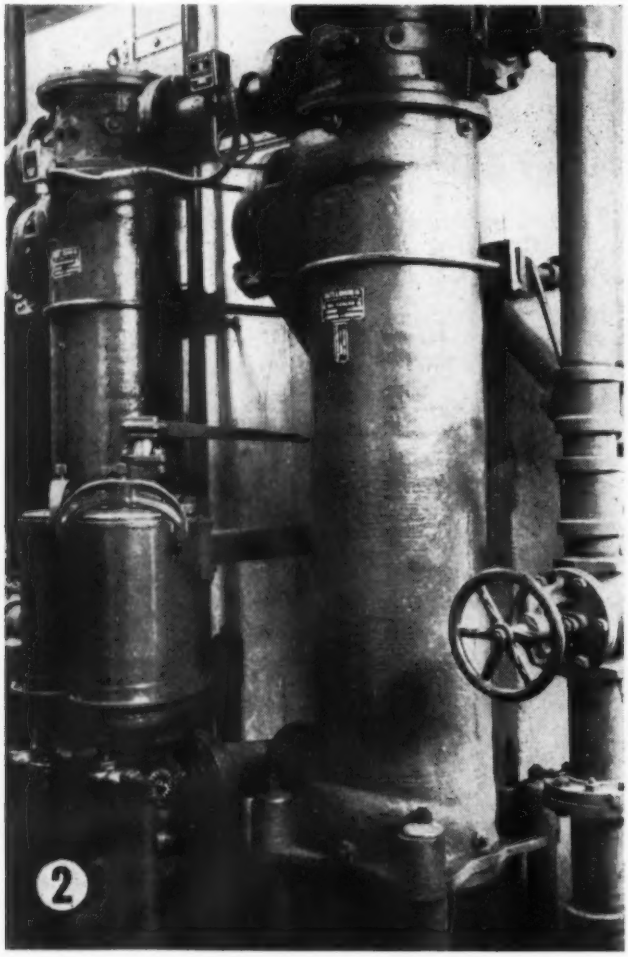
WHAT DOES IT TAKE to hang up a diesel-plant record like that of F W Stock & Sons' 2000-bbl flour mill at Hillsdale, Michigan? What's behind 10,000,000 kwhr and 20,000 hr of trouble-free operation in the short space of three years and from a single 1250-hp engine? The answer lies in sound choice of prime mover, provision of protective accessory equipment, and a program of regular preventive maintenance. Here's the story.

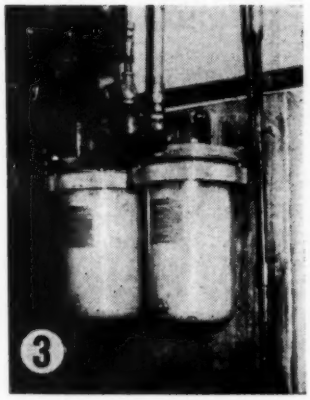
Stock & Sons have milled flour for 80 years and have had considerable experience with alternate sources of power. In March 1939, they replaced an old steam plant with a 5-cyl 17x25-in. 257-rpm 1250-hp Nordberg air-injection diesel engine, with Woodward governor, driving a 900-kw Elliott generator with 20-kw V-belted exciter and Allis-Chalmers voltage regulator. All mill equipment is motor driven.

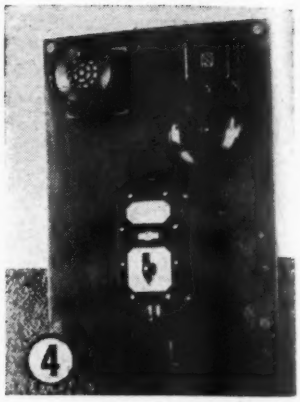
In designing the power system, first requirement was dependable service with freedom from production interruption. To this end, the company chose a heavy-duty prime mover and installed an engine with adequate reserve power so that it could operate at an efficient load factor and never suffer the ill effects of constant overloading. Peak loads run to 700 kw; average is between 600 and 650. Thus, the engine operates normally at about 70% of rated capacity and never above 80%.

Second requirement was operating economy. This resulted in choice of a diesel capable of burning a low-priced fuel oil. The engine consumes No. 5 fuel, delivered at 5.5 cents a gallon, and has averaged a little better than 11 kwhr per gallon of fuel consumed during the full three years. This unit is, in fact, more economical than an engine producing 13 kwhr from a gallon of fuel costing 1 cent more. The operating record, reproduced above, gives hours run, fuel consumed, kwhr per gallon of fuel for a typical 12-month period.

Fuel, lubricating oil, air and cooling water supplies are designed to protect the engine and promote ease and efficiency of operation.







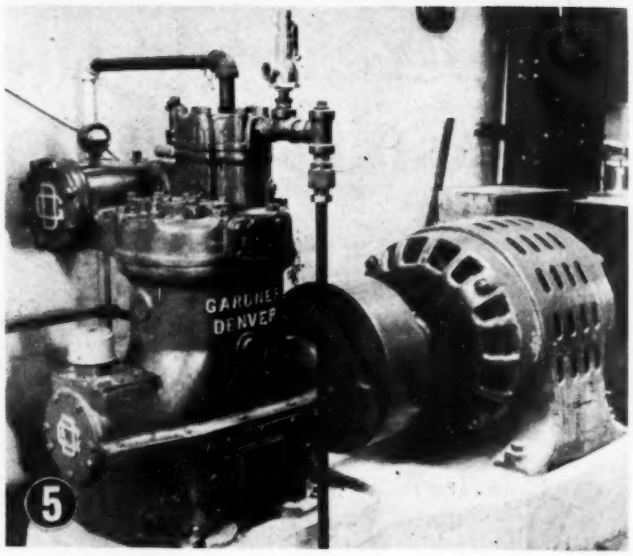


Fig. 2—Engine accessories: cooling-water heat exchanger, lubricating-oil strainer, lube-oil cooler. Fig. 3—Duplex pressure filter cleans lubricating oil continuously. Fig. 4—Alarm for low oil pressure or high water temperature. Pyrometer gives exhaust temperatures. Fig. 5—Motor-driven compressor can supply diesel starting air

Fuel must be heated before it is moved or supplied to the engine. Oil from the nearby refinery of Aurora Gasoline Co is still warm when it reaches the plant so that it is unloaded without difficulty into the two 25,000-gal outdoor storage tanks, above ground. Fuel tanks, indoors and out, are heated by steam from the heating plant. Two Blackmer transfer pumps handle fuel from storage to two 275-gal day tanks buried outside; oil then flows by gravity to a 100-gal supply tank indoors. It is partitioned, with a section for lighter oil, which can be used to start the engine in extremely cold weather. In practice, it has almost never proved necessary to switch from the usual fuel. A pump built into the engine takes oil from the supply tank at 160 F and delivers it to the American Bosch injection pumps. All fuel is filtered between storage and day tanks; a Buffalo meter measures consumption.

All bearings are pressure lubricated with Shell oil by a pump driven from the engine crankshaft. A Manzel lubricator supplies Viscosity Oil Co's 105A cylinder oil. The lube circuit includes a Schutte & Koerting oil cooler and a Nugent duplex pressure filter, Fig. 3. Chief Engineer Wight prefers to use both filter elements together since his schedule permits adequate servicing when the engine is off the line. A motor-driven auxiliary lube pump serves as a standby and is used regularly to bring up pressure before starting the engine and keep up pressure in shutting down.

Lubrication Costs Low

Lubrication experience has been highly satisfactory. With consumption at 4500 rated bhphr per gal, diesel lubricating cost has been less than $.00018 per kwhr. Liner wear has been slight and there has never been a stuck ring. No oil is thrown away. Periodically, a portion of the oil is drawn from the bearing supply and put through a Youngstown-Miller activated-clay reclaimer.

A closed cooling system protects the engine, with an Allis-Chalmers motor-driven centrifugal pump circulating soft water through the engine jackets and a Schutte & Koerting heat exchanger, Fig. 2. Makeup water passes through a Permutit softener before entering the closed system. Raw water flows by gravity from a nearby creek into a supply well, and is then sent through the oil cooler and heat exchanger. Part of the hot water leaving the exchanger goes to a softener and then to the feed-water supply of the steam boilers. The rest of the water is piped to a spray pond, from which water can be pumped back through the raw system. In emergency, either the raw- or soft-water circuits can use city water.

An 8-element American impingement filter in a room over the engine room cleans intake air. Pressure in the starting-air bottles is usually kept up by the engine compressor, but the plant also has a separate Gardner-Denver compressor driven by a 40-hp motor, Fig. 5.

To keep track of engine performance, well-trained operators make full use of U. S. Gauge Co and Foxboro gages, Motoco thermometers, Brown exhaust pyrometer and a well-equipped General Electric switchboard. A Minneapolis-Honeywell alarm system provides further protection by warning of low lube pressure or high water temperature, Fig. 4. Indicator cards are taken periodically and corrective action follows the first sign of trouble.

REFRIGERATION NOTEBOOK — 5

Evaporative Condensers Reduce Water Bills 90–95%

By TERRY MITCHELL, ME, *Frick Company*

WHEN REFRIGERATING PLANTS do not possess spray ponds, cooling towers or their own wells, they can reduce condensing-water cost drastically with an evaporative condenser. Its small pump keeps a thin rain or spray of water running over its coils; fans, mounted above, draw in a stream of air, cooling the spray water and evaporating enough to maintain a satisfactory condensing pressure. Some designs have finned coils, others bare pipe.

Evaporation of one pound of water absorbs some 1000 Btu. Used in a regular shell condenser, the same amount of water would take up only 15 to 30 Btu. It is good practice to circulate one gallon of water over the coils per minute for each ton of refrigerating capacity. Theoretically, only 2 or 3% of the water has to be evaporated: 5% makeup is usually allowed. From 180 to 300 cu ft of air is drawn through the coils per minute, per ton.

There are two things to watch on this device: Be sure that the condenser is big enough for the load in your climate; and keep the coils clean.

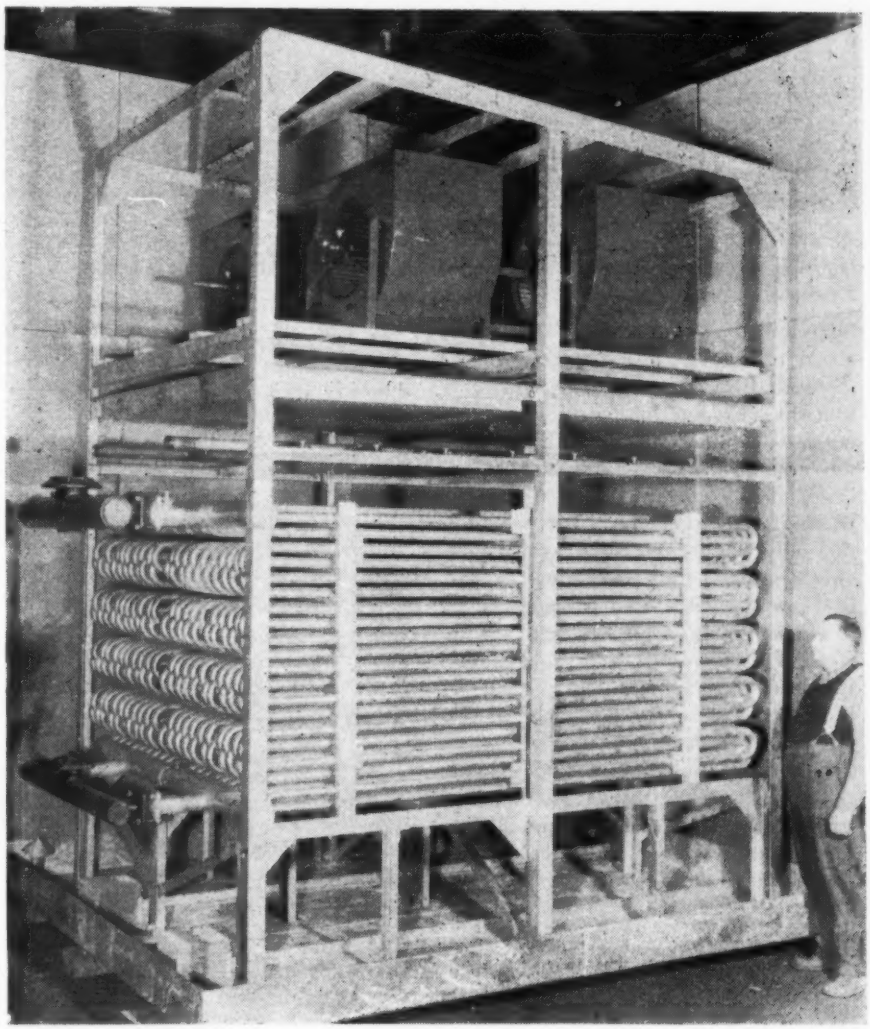
Evaporative condensers are sensitive to changes in air temperature and humidity and, because of limited space in the coils, to the effect of non-condensable gas.

Unless the coil surface is really liberal, the differential between outside air temperature (wet bulb) and temperature of the liquid leaving the condenser gets so wide in warm, moist weather that the head pressure runs out of sight. Differential should not be over 20 F in average summer weather. Otherwise, increased power cost eats up any savings in the water bill. Many plants have lowered both power *and* water costs with well-designed evaporative condensers.

An example shows what happens when a 30-F temperature differential is used in figuring the condenser's rating. Remember that in average practice foul gas mixed with refrigerant raises the ammonia condensing pressure to a point corresponding to a temperature 5 F above the liquid temperature: with Freon-12 this increase amounts to 13 F. Presence of any larger quantity of air and foul gas indicates that the system should be purged. Thus in an ammonia system, with liquid at 105 F, condensing pressure corresponds to 105 plus 5 F, or 232 psi—all based on 75-F air. With a 20-F differential, the liquid would come off at 95 F and the head pressure would correspond to 95 plus 5, or 197 psi (wet-bulb air temp).

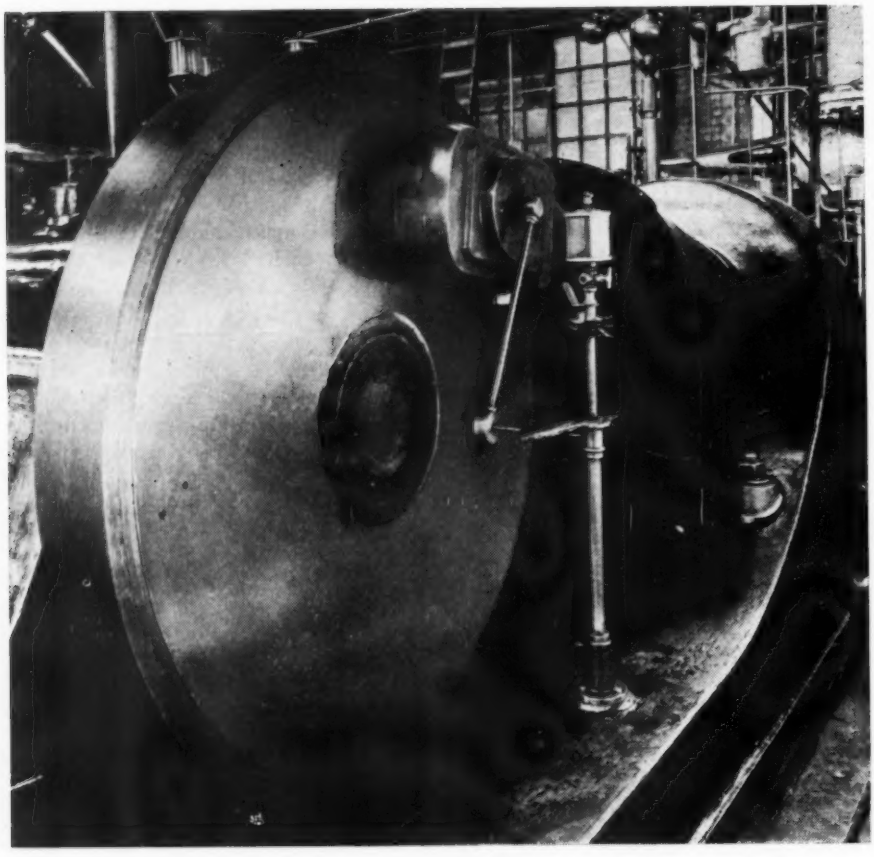
If coils are of bare pipe arranged in evenly staggered rows, cleaning is easily done by passing a brush between the rows to reach each pipe on eight "sides." Heavy galvanizing or frequent painting with asphaltum is advisable to keep down rust.

But the worst enemy is scale left by the water as it evaporates. On bare coils, scale can be overcome by cleaning the pipes and changing the water in the pan each day. On either bare or finned coils, chemical cleaners are helpful as they soften scale. They do not, however, stop scale accumulation from hard water: This is done by regular cleaning and by bleeding away a little of the treated water as it leaves the circulating pump, or by changing all the water regularly, as mentioned. With very hard water, and its high concentrations, you may have to drain off two or three times as much as the float valve would ordinarily admit.



Water sprayed over condenser coils falls to reservoir pan. Air enters screened openings at bottom of case (housing removed) and flows up through tube nest to exhaust fans

PRACTICAL AIDS TO OPERATION



Shrink Band Tightens Engine Crankdisk

SOMETIMES THE CRANKDISK on large steam engines becomes slightly loose, discovered by a careful inspection, but sometimes existing for a long time without the operator knowing it. To tighten the crankdisk on its shaft, shrink a heavy steel band around it, as in the photo. It has generally been believed that only where the disk was considerably weakened by a long crack at its bore or elsewhere would shrinking a steel band around it give reinforcement. However, according to H J Vander, Hartford Steam Boiler, Inspection & Insurance Co, in the *Locomotive*, experience has definitely shown that a steel shrink band, if properly designed, closes the bore of a crankdisk onto its shaft with such force as to produce a permanently tight fit. In other words, the tightening effect of the band is transmitted through the radial depth of the disk, a fact not readily believed.

No harm can result to the crankdisk if the band is a little tighter than needed to tighten the disk to its shaft. The band must be made from steel that has an elastic limit of at least 40,000 psi. While the band may be made from a solid ring machined to the proper dimensions, it can also be made from bar stock, formed in bending rolls and its ends joined by double-vee butt-welding.

This type of repair, for loose crankdisks, compared with making a new disk, saves both material and time, which are highly essential to meeting war demands on power equipment.

Valve Adjustment Cures Pipe-Line Vibration

RECENTLY I FOUND a complete cure for a bad case of boiler and steam line vibration. The engine is a double-ported balanced slide-valve unit operating at 200 rpm, with ports 10 in. long, a 15x18-in. cylinder. The ports give an admission length of 20 in. when the valve is moving at maximum rate of travel. This sudden inrush of steam into the engine unbalanced the forces on the boiler shell over the area of a 5-in. outlet into the steam line to a rhythm of 400 reversals per minute.

We found that this action occurred with sufficient force to cause springing of the U-bolts suspending the boiler by its steel-strap lugs. For several years a system of heavy threaded braces reduced the vibration to where it was not serious but did not make a complete cure. A new boiler suspended by straight-line bolts behaved much better than the old one but if not braced would cause a tremor in the ground around its foundation.

To find a cure without installing a large receiver in the steam line from boiler to engine, I tried operating with the stop valve at the boilers partly closed. This greatly improved the conditions and the engine was operated five years that way. One day I tried cracking the throttle and opening the stop valve, but this did not work as well as the other arrangement because the effect of steam storage in 48 ft of 5-in. pipeline was lost. Also the throttle valve could not be closed as much as the stop valve before affecting the engine speed.

I then tried operating with the two valves partly open and found that when the stop valve was opened one-half turn and the throttle valve three-quarter turn, vibration was completely eliminated and full load could be carried on the engine. Flanged and threaded joints that previously leaked easily now remain tight.

Vancouver, B. C. R MANLEY ORR

Compressed Air Transmits Power-Plant Signals

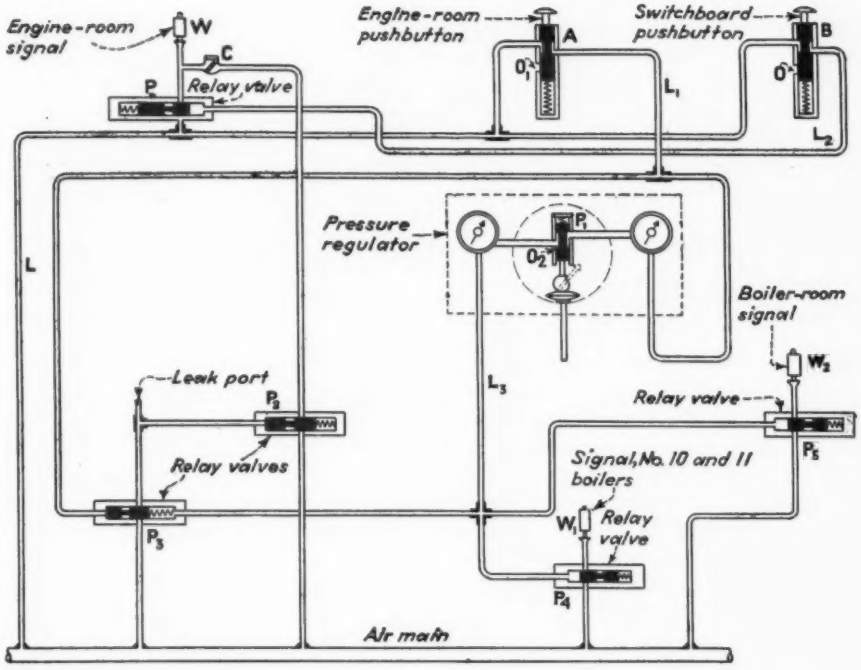
THE ENGINEERING DEPARTMENT of a large office building in New York city, being air minded, has built and installed a compressed-air signal system in the power plant. This system consists of a number of spring-loaded piston valves P to P_5 and two spring-loaded pushbutton valves A and B, one on the switchboard and the other in the engine room, that operate signal whistles. A signal for low fuel-oil pressure is also tied into this system through valve P_1.

With this system the switchboard operator can signal the engine room; the engine room can signal the boiler rooms and get a return signal; and if the oil pressure at the burner drops

below a safe value all signals sound. Normally relay valves P, P_2, P_3, P_4 and P_5 are closed, as in the figure. These valves all connect to full air pressure. Air line L leads to the pushbutton valve in the engine room and on the switchboard.

Valve A is normally in the neutral position, as shown, so that air passes through it into line L_1 and to relay valve P_3. From line L_1 air pressure is transmitted through valve P_1, on the oil-pressure regulator, to relay valves P_4 and P_5 to hold them closed. Relay valve P_3 is held normally in the position shown by its spring but has air pressure applied to both ends. Valve A can quickly bleed the air from line L_1 but valve P_1 restricts air flow through it so that air pressure change is slower in line L_1 than in L_1 to delay the operation of valve P_3.

Pressing the switchboard button down on valve B closes the entrance of pressure pipe L into the valve and bleeds pipe L_2 through port O. This releases the pressure from back of the piston in relay valve P, and the piston is pushed to the right by its spring to sound whistle W with air from line L. When pushbutton B is released its valve moves to the up position and applies air pressure to close relay valve P to stop the whistle blowing.



Pressing down the pushbutton on relay valve A, shuts off air from line L to the valve and bleeds line L_1 through port O_1. Pressure is quickly removed from the left-hand end of valve P_3 and it is held in the position shown by its spring. Air from line L_1 bleeds off through valve P_1 to the point where the springs in valve P_4 and P_5 can push their pistons to the left to sound whistles W_1 and W_2 in the boiler rooms.

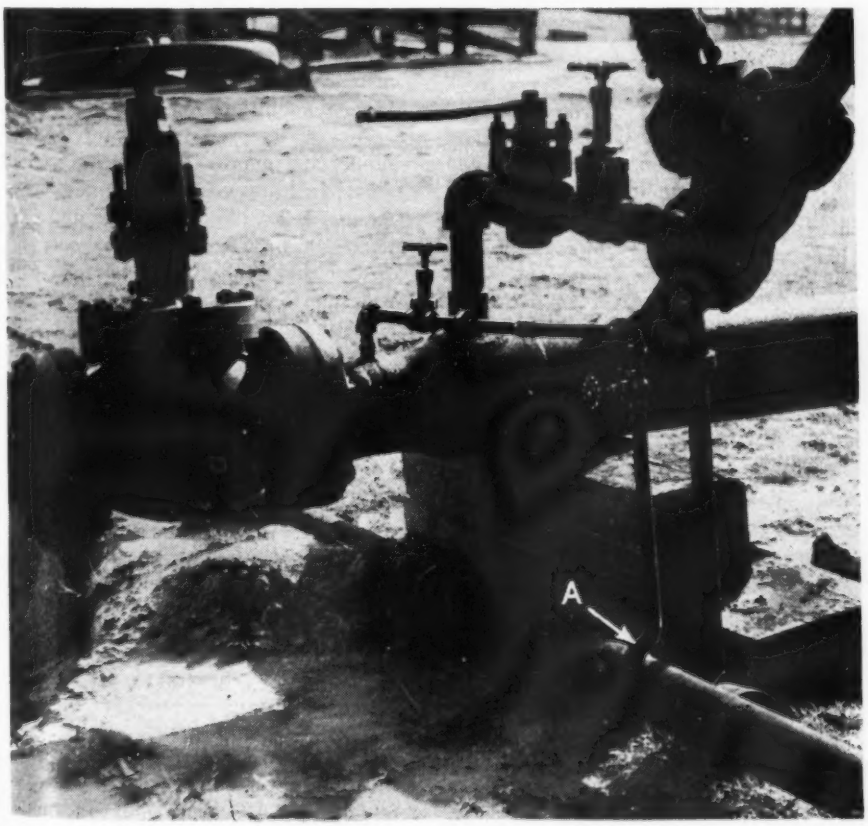
When pushbutton A is released air pressure builds up in line L more quickly than in line L_1 and forces the piston of valve P_3 to the right to admit air pressure on valve P_2. This valve moves to the left and admits air through check valve C to blow whistle W. Before whistle W can blow, pressure in line L_1 must drop low enough to blow whistles W_1 and W_2. With this arrangement, when the pushbutton in the engine room is released and whistle W blows it is known that the boiler-room whistles have sounded. The leak-off port between valve P_3 and P_2 prevents pressure building up behind valve P_3 and accidently sounding whistle W.

Oil pressure on the burners holds valve P_1 in the up position against its spring. If the oil pressure fails

Steam Blows Out Blowdown Pipe

BLOWDOWNS FROM SEVERAL oil-field boilers connected into a line that ran about 100 ft to a discharge pit. Sludge, scale and other matter accumulated in this line and reduced its carrying capacity. To blow out this line a small live-steam connection was welded into it as at A, in the photo. This connection was made at an angle in the direction of flow to obtain full advantage of the injected steam against the accumulation in the pipe. It was found that this connection did the trick very nicely.

Santa Monica, Calif. J C ALBRIGHT

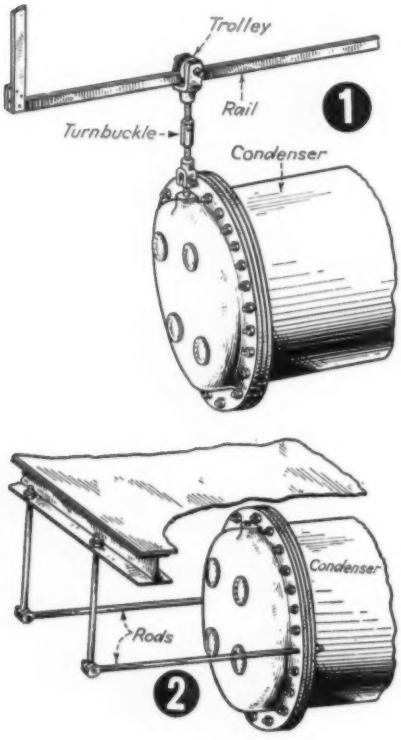


for any reason, the piston of valve P_1 moves down, closes line L_2 and bleeds line L_3 through port O_3. Reducing the pressure in line L_3 causes all three whistles to blow until oil pressure has been restored.

FIELD EDITOR

Easy Way to Remove Condenser Heads

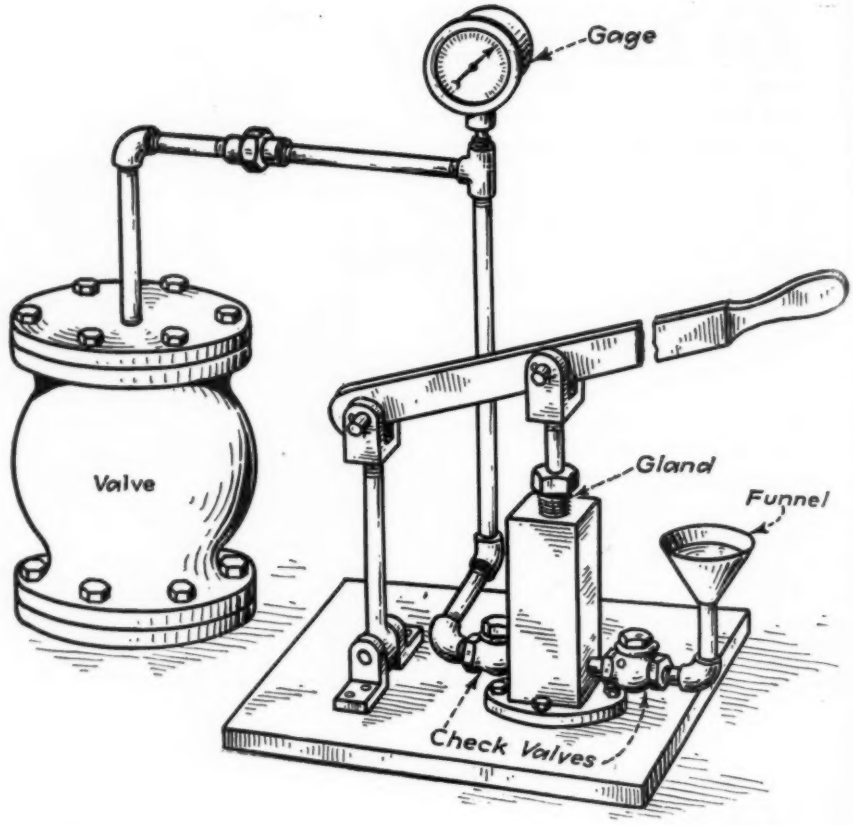
IN THESE TIMES when industrial-plant operating engineers do not have too much help to run their plants, maybe a suggestion by an old marine engineer will come in handy. On board a ship a turnbuckle and trolley on a rail, as in Fig. 1, are used quite frequently to handle condenser heads. With this device the head can be easily removed



or replaced, and positioned exactly on its bolt holes.

Where space is not available in which to install the turnbuckle and trolley, the arrangement, Fig. 2, can be used. This consists of four bolts with eyes, threaded at their straight ends. To remove a condenser head support two of the eyebolts from overhead a distance apart equal to that between the two bolts on the horizontal diameter of the condenser head. Remove the two bolts on the horizontal diameter of the condenser head and put the other two eyebolts in these holes, as in Fig. 2. If the eyes of each pair of bolts are not linked, they may be bolted together. Then the head bolts can be removed and the head moved back out of the way on the rods.

New York, N. Y. P E MEREDITH



Hand Pump Tests Reconditioned Valves

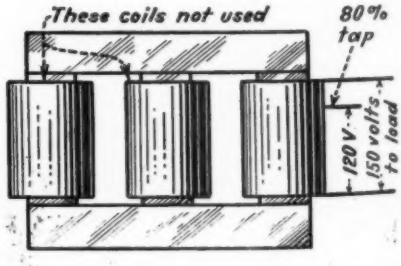
I ONCE WORKED in a machine shop where, among the wide range of work handled, we reconditioned high-pressure valves from ships. It was important that these valves be tested before and after being repaired. To provide the high pressure we built a pump like that in the figure. The cylinder we made from a piece of square steel stock welded to a round steel-disk, and bored it for the plunger and the suction and discharge connections. We counterbored the top of the cylinder for packing and a threaded packing gland. Two check valves were pressed into use for a suction and discharge valves. The piston was operated by a lever as indicated.

How the pump was connected to the valves depended on their type and what we wanted to test for. The figure shows a valve body blanked off and connected to the pump to test for cracks or pinholes. We also used the pump to test for leakage before and after reconditioning the valves. In this way we not only determined the condition of the valve before starting work on it, but we could also be sure that the valve was returned in good condition. When we were ready to make a test, water was poured in the funnel and pumped into the valve until the desired pressure was obtained. When making a test like that in the figure we poured the valve body practically full of water before putting on the top blank, which on a large valve saved considerable pumping.

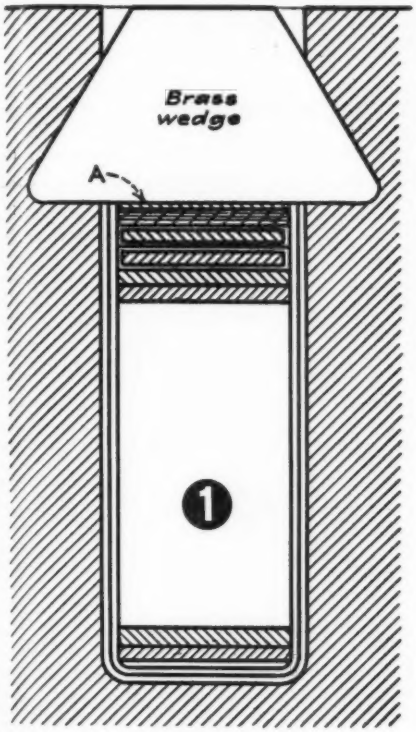
Great Neck, N. Y. S M ELONKA

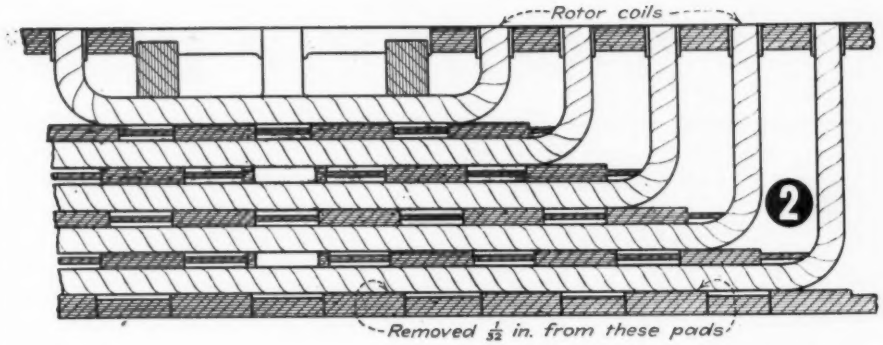
Compensator Coil Serves as Transformer

ON ONE OF OUR POWER CIRCUITS for intermittent operations we found that the usual 120 volts used for this work was not sufficient. Looking over the



spare equipment for something that we might use to boost the voltage we found an old 3-phase 440-volt motor-





Repairs Turbine-Generator Rotor Winding

A 6000-KW 3600-RPM steam-turbine-driven alternator in our plant developed a ground in the field windings. This fault showed up only after the unit had been operating for some time under load. When the generator stopped the ground disappeared. Even a 2500-volt test to ground on the 125-volt field winding failed to produce a ground with the rotor at standstill.

We decided that the combined action of the rotor speed and expansion of the coils, resulting from increased temperature when current was flowing in them, caused the ground. We removed the rotor and then took off the shrouds over the coils ends. With normal current flowing through the field coils we found that the coil ends had a longitudinal movement of 0.03 in.

This movement had forced the coil ends so hard against the end shrouds that the coils buckled around the ends of the brass slot wedges. On one of these wedges the buckling had broken the insulation on the top of the coil and caused a ground as at *A*, Fig. 1. To provide for expansion of the coils we cut 1/32 in. from the insulating ring inside the end bells over the field-coil ends, as in Fig. 2.

With the field winding hot and grounded we tested from each slipring to ground with a voltmeter. From one ring to ground we got a reading of 35 volts and from the other to ground 46 volts. From these readings we drew the conclusion that the ground must be somewhere near the center of the winding. Working on this theory we started to remove end sections of the brass slot wedges near the center of the winding. The fourth slot that we knocked the end section of wedge from proved to be the correct one. The top turn of the coil had grounded to the end of the brass filler strip under the wedge, but had not seriously damaged the coil.

Substituting a mica filler strip for the brass one thoroughly insulated the coil when the brass slot-wedge section was replaced. We then reassembled the machine and put it back into service. It has been running now for nearly a year without any trouble.

When the trouble developed we considered sending the rotor back to the manufacturer for rewinding but decided to try doing the job ourselves and save the several thousand dollars that it would have cost to make the repairs in an outside shop.

Columbus, O. FRED E SCHUBERT

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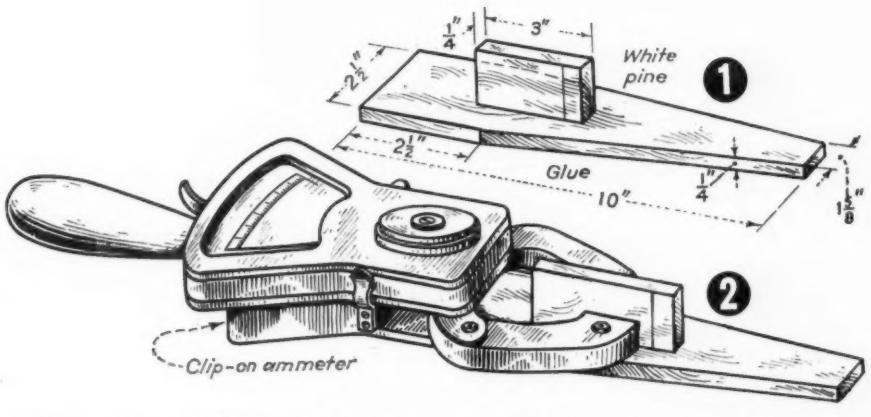
starting compensator that we put into service.

As one coil of the compensator was good for 440 ÷ 1.732 = 250 volts, this is all that we used, because the current needed was small. We connected the 120-volt line to the 80% taps on the coil and the load circuit to the coil ends, as in the diagram. This gave 120 ÷ 0.8 = 150 volts to the load, which was ample for the operation. We did not remove the other coils from the transformer, but insulated the ends of their leads.

Chicago, Ill. J B MULLINS

Low-Reading Ammeter Checks High Currents

A TURBINE GENERATOR feeds our main busbar through two oil circuit breakers in parallel. Unequal heating of the two breakers made us suspect that the load did not divide equally between them. Not having transformers and instruments to check the load division we used a 50-amp clip-on ammeter and an adapter. The adapter was made of white pine of the dimensions, Fig. 1, and is applied to the clip-on ammeter as shown in Fig. 2.



To calibrate the ammeter we held the end of the adapter at right angles against a section of busbar in which the value of the current was known. This gave us a ratio between the actual current and the ammeter reading. It was then a simple matter to check the current flow through each of the oil circuit breakers.

Amherstburg, Ont. G E ELLIOTT

READERS' PROBLEMS

Questions From Our Readers

Question 1

Needs 180-Cycle Power Supply

WE WOULD LIKE TO HAVE *some information on building a unit to supply 180-cycle 3-phase 220-v service. Our plant is supplied with 60-cycle power service and we have on hand a 10-hp 3-phase 60-cycle 220-v 1800-rpm driving motor. We also have a 10-hp 3-phase 220-v 60-cycle 4-pole motor with a wound rotor grouped for eight poles.*

What changes must we make in this latter motor in order to get 180-cycle 220-v current from its sliprings if we drive it in a reverse direction with the first motor? Must we drive the wound-rotor machine overspeed to generate 180 cycles? Can POWER *readers advise us on complications we might be confronted with and what amount of power we can expect from this unit?—KCJ*

Question 2

Engine Foundation Trouble

ONE OF OUR OLD RECIPROCATING *steam engines oscillates back and forth on its brick foundation approximately* $\frac{1}{16}$ *in. As the unit is quite old considerable oil seepage has entered the foundation. Individual bricks still appear tight, as no movement can be detected. Tightening the foundation bolts has not corrected the trouble. Grouting still remains hard and strong except for the small clearance between the edge of frame and grout. We assume this clearance was caused by engine movement.*

Can we correct this trouble by regrouting on top of the old brick or should the entire foundation be rebuilt? Could we use angle guy bolts anchored in the concrete floor and connected to lugs welded to the engine frame to eliminate this end motion?

Extended outage of this machine, while possible, will require purchase of outside power so we would like to know how we can make either temporary or permanent repairs in the shortest possible time.—MC

Answers to June Question 1

The Question

Testing Shaft Insulation

WE HAVE A LARGE *synchronous motor generator set with the two rotors solidly coupled together and supported by four pedestal bearings. Each bearing pedestal is separated from the main bedplate by one sheet of insulation and several heavy metal shims. All pedestal holding-down bolts are insulated except for a so-called grounding bolt in one inboard bearing. Oil piping and thermocouple conduit from each bearing contain insulated couplings.*

Our usual practice requires removing the ground bolt, and raising the shaft at each bearing before testing its pedestal insulation.

When inspecting the bearings some time ago we found considerable pitting on the lower babbitt of the inboard ungrounded bearing. On test this bearing insulation was in normal condition.

Why did the electrolysis occur at this ungrounded bearing? Can POWER *readers illustrate some means of overcoming this condition?—OFC*

Bypass Roller Bearing

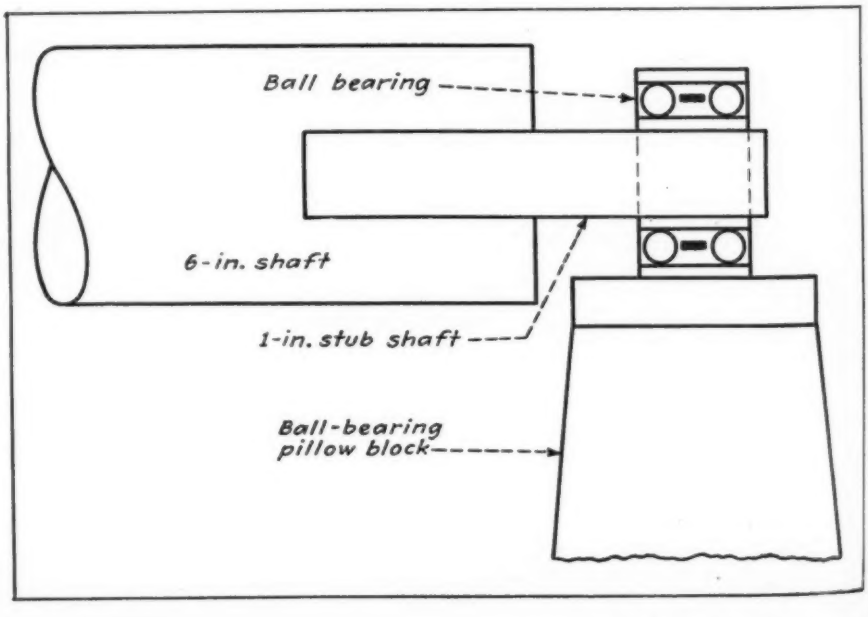
PERHAPS THERMOMETER COUPLING conduit or tools caused an accidental temporary short circuit of OFC's bearing pedestal at a time when bearing current was present. This caused arcing across the rotating shaft and bearing which pitted that particular bearing. A high current would also affect the shaft.

The main problem lies in ascertaining bearing current, not checking shaft insulation. Bearing current voltage is relatively low and because of its frequency, very difficult to detect with ordinary test instruments. However, a simple way to check bearing current is to place a wire between the rotating shaft and bedplate; if bearing current is present this will draw a visible spark. To overcome bearing current, the usual method is to insulate the pedestal from the bedplate as OFC has done. Nevertheless, this does not eliminate accidental short circuits and bearing pitting.

The sketch shows how we eliminated bearing current on a synchronous motor-generator set having a 6-in. shaft. We installed an auxiliary roller bearing bypassing shaft current through this shunt. I should like to add that before installing this permanent roller bearing we experimented with a brush holder and carbon brushes rubbing on the rotating shaft, discharging shaft current in this manner. However this was an unsightly contraption and, being in an unusual place, attracted more attention than other more-intricate equipment. After a considerable trial period (16 months) we removed the brushes and attached the auxiliary roller bearing.

CARL BACHMANN

Schenectady, N. Y.



Use a Galvanometer

To AVOID lifting the shaft to test the pedestal insulation, OFC should use either a megger or a galvanometer. If the insulation is defective in any way, placing the prods of the galvonometer between the pedestal and bedplate will give a deflection of the needle.

The second part of his problem is answered by the fundamental fact that electrolysis takes place because of the contact of two dissimilar metals.

New York, N. Y. P DONOHUE

Ground Other Bearing

IT SHOULD NOT BE NECESSARY for OFC to lift the shaft to test pedestal insulation unless an over-all test indicates sub-normal insulation resistance. The test can be made by removing the grounding bolt and testing between the bedplate and shaft. If normal resistance is obtained in this manner, it is not necessary to test each pedestal separately. If resistance of the oil film between bearing and shaft affects the test, a temporary jumper can be used to connect all pedestals and the resistance measured between the jumper and bedplate. If the test indicates subnormal resistance, and unless the defect can be located by examination, it may be necessary to lift the shaft and test each pedestal as well as pipe and conduit couplings separately.

Electrolysis, if it actually causes pitting of the ungrounded bearing, can be accounted for by leakage through the bearing insulation, possibly caused by deposits of conducting material, impurities in the oil or moisture. This condition might not have been present when the test was made.

Cleveland, Ohio E F DOWIS

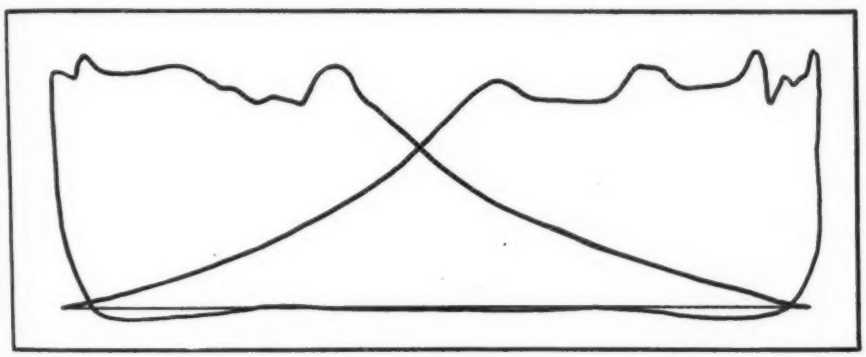
Metal Chip May Be Imbedded In Insulation

TO FACILITATE TESTING it is becoming more or less standard practice to insulate all of the bearing pedestals from the base and then to ground one of them to protect the operator from getting an unexpected shock.

The procedure is to remove the ground and apply a test voltage between the shaft and base. This tests all of the pedestals at once. If the test shows a fault, each pedestal must be tested in turn by raising the shaft enough to slip a sheet of paper between the shaft and lower half of bearing. The oil rings must be raised out of contact with the shaft. Usually a test voltage of 120 with 50-watt lamp in series is satisfactory. If the lamp glows, the insulation is at fault.

A ground on a pedestal may be caused by a metal chip pressed into the insulating shim. Contact may not be established unless the rotor weight is on the bearing. Insulating sleeves and washers on the holding down bolts may be cracked or an insulated dowel may be at fault. Insulation in pipe and conduit leading to a bearing must be tested. Insulated couplings in water lines are frequently found coated with rust and scale from the pipe.

To account for pitting of the ungrounded inboard bearing caused by ordinary shaft currents, it would be necessary that it and one of the outboard bearings be grounded. Perhaps there is a coupling cover between the two inboard pedestals, taken out before the test was made, that removed the ground.



Bearings and journals sometimes get damaged by power current flowing to ground during a fault on the rotor. Perhaps the damage to the inboard bearing was caused long ago by such a fault, and has just been discovered.

There is one other source of bearing current that cannot be prevented by insulation, and that is homo-polar currents caused by a magnetized shaft (may be magnetized only when running). The usual remedy is to make the bearing shell of non-magnetic material. This has the effect of a large air gap in the local magnetic circuit. Occasionally a demagnetizing coil in series with the exciter is placed around the shaft. This is difficult to accomplish on a large machine without dismantling, unless the coil is wound in place. The coil need not rotate.

Schenectady, N. Y. L W RIGGS

Make Analysis Of Bearing Oil

IF OFC HAS DEFINITELY established that the metal pitting is a result of electrolysis he should carefully check the motor-generator windings for insulation faults. Electrical data is not given, but if this is a dc generator the fault is probably connected with it or the exciter, the action sounds more like direct than alternating current.

Circulating currents frequently exist in generator frames and shafting where there are no faults. Circulating currents are usually difficult to trace. They may be influenced by impurities in the babbitt metal, by the lubricating oil not being neutral, or by the oil picking up impurities which make it slightly conducting. In several instances circulating currents have been stopped by carefully grounding all pedestals as well as the shaft. It is assumed that the solid coupling is not an insulated type.

It is usual in many plants to check machine-insulation resistance to ground without dismantling the rotating parts. If faults are found, disconnect parts for separate checks to locate the trouble.

Saint John, N. B. C G CLARK

Answers to June Question 2

The Question

Compressor Piston-Ring Leakage

AIR REQUIREMENTS AT OUR PLANT *have gradually increased until the compressors operate at full load during a considerable portion of the working day. We inspect the automatic valves and keep them in good condition. Since these machines are several years old we think it is possible that the piston rings may be leaking, and causing a reduction in output.*

We understand that ring leakage can be detected by taking a cylinder indicator diagram. Can POWER *readers*

illustrate how piston-ring leakage changes the compression line on an indicator diagram? Since this line never coincides with the true isothermal or adiabatic line we have been unable to learn much from diagrams.—JG

Rock The Compressor

IN ACTUAL PRACTICE the compression curve in a compressor follows neither the isothermal nor adiabatic curves, but will actually be somewhere in between, depending upon several factors such as the compressor speed and the cooling effect of the cylinder jackets. Since it is difficult to determine the exact compression curve without referring to the curve of an identical machine which has been equipped with new rings, the amount of leakage in a compressor cannot be determined by the compression-curve slope on an indicator diagram. A more practical method is as follows: Shut down the compressor after normal pressure has been obtained in air receiver. See that the unloader pilot is tripped to the loaded position. By rocking the compressor back and forth against compression the operator can determine if there is any great amount of leakage in much the same manner that the compression in a gasoline engine can be determined more or less by feel when turning it over by hand.

Quincy, Ill. R F WILLIAMS

Broken Rings Cause Serious Leakage

CHECKING LEAKAGE within a cylinder from indicator cards is usually a difficult proposition. In the writer's experience indicator cards, as a rule, may be analyzed only by comparing them to other cards where conditions are known to be as near perfect as possible. In other words a standard indicator card will have to be taken from the machine under the same pressure conditions with the same instrument and indicator-drive setup. Cards taken subsequently, if they differ from the standard, which of course is taken when the machine is in good condition, definitely indicate when something is wrong and will usually show where to look for the trouble.

Piston-ring leakage from the discharge to the intake side tends to lower the compression line. It will also tend to make the re-expansion line more steep.

The writer has made artificial leaks in piston rings and, on a moderate-speed unit, has found that they cause relatively little loss. There is not time enough for any great amount of leakage to take place because of the frequent reversal of flow. There is of course some loss, but it is not a major one.

Leaky piston rings which seriously affect compressor output will generally be the result of piston-ring breakage or failure; this would become evident from the noise they would cause. Generally, if piston rings are quiet, they are doing their job and leakage need not be given too serious consideration.

Westfield, N. J. C W GIBBS

Indicator Card Shows Common Faults

THE INDICATOR CARD will serve to show the most common faults of air compressors but it should be noted, however, that compressor cards are produced in an opposite manner to that of engine cards.

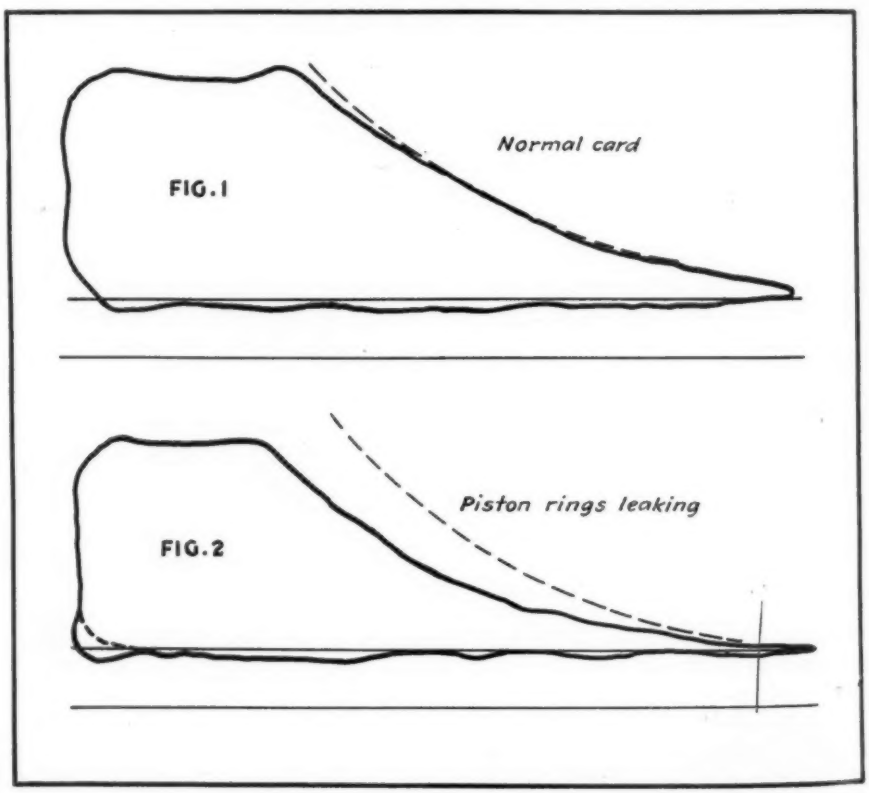
A good method of interpreting compressor operation is to compare an actual card with an ideal one based on a theoretical line showing where the compression curve should be. This theoretical curve could be considered as corresponding to the isothermal curve used in engine card calculations and should be laid out along the diagram in accordance with one of the various rules for locating such curves. Any large deviations from the theoretical curve would indicate poor operation and low efficiency, with a consequent high power cost. Small deviations from the curve could naturally be expected.

Fig. 1 and 2 shows approximately where the theoretical curve would appear on a diagram from air compressors, Fig. 2 showing the low compression line caused by leaky piston rings. Leaky inlet valves would produce much the same effect on diagrams. Allowance should also be made for the type of valve gear used on the compressor in question, as normal cards taken from units with different valve gear will differ somewhat in form with the type of valve gear, even though the compressors are in good condition. The principal differences appear in the portion of the diagram showing the inlet functions.

Jersey City, N. J. I S CHAMBERLAIN

Many Factors Affect Compression Line

UNLESS JG's PISTON-RING or valve leakage is quite serious, the indicator compression line will not provide a clear picture of the extent of such leakage. In a normal compressor, the compression line lies somewhere between the adiabatic and isothermal curves. It is impossible to determine exactly where, because the effect of jacket cooling, which to some extent determines the location of the compression line, is it-



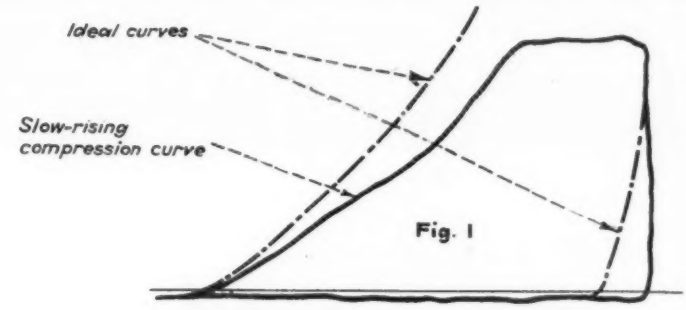


Fig. 1

Piston Rings or Inlet Valves Leaking

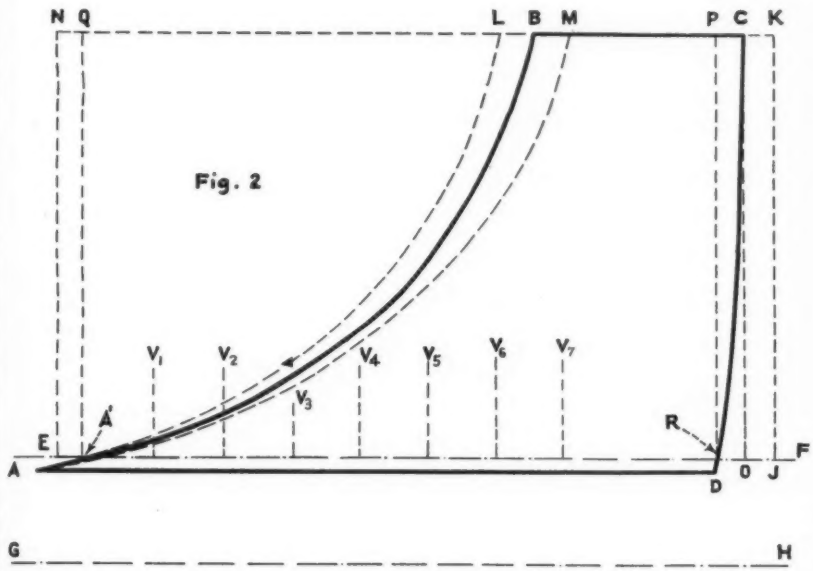


Fig. 2

possibly offsetting each other, and with the extreme difficulty of exactly placing the true compression line on an ideal card, it will be seen that the indicator card, while often helpful, is not a true measure of what is occurring.

If there is suspicion of leakage past either the piston rings or the valves, they should be carefully inspected by a competent mechanic.

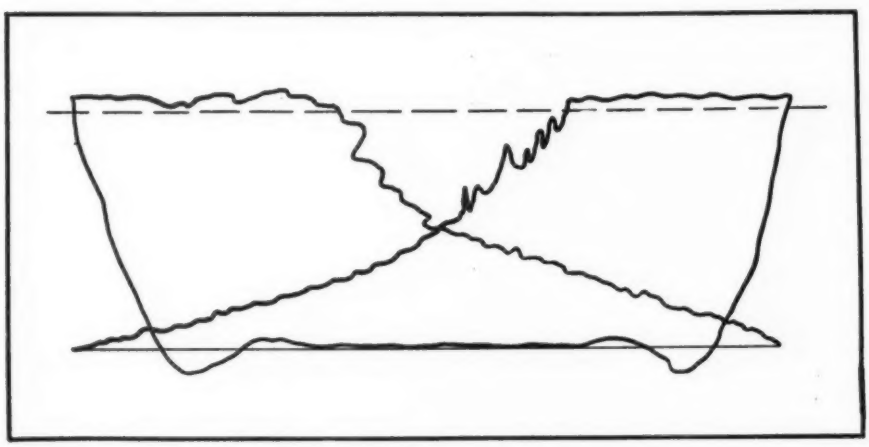
Of course, it is always possible that the plant requirements for compressed air have increased and caught up with the full-load capacity of the compressor.

Buffalo, N. Y. H H MILLER

Test The Pressure Drop

AS JG DID NOT STATE whether the compressors are single- or multi-stage units, we may assume they are single stage. In this case the accompanying diagram will illustrate the effect of leaky piston rings. The stepped appearance of the compression curve, getting more pronounced towards the end of the stroke, or with an increase in pressure, is an indication of defective piston rings if all other conditions are correct. (Sketch below.)

JG should check the conditions of his piston rings in the following order: (1) Inspect the cylinder for scoring, and (2) see if lubrication is effective. Insufficient cylinder lubrication contributes to ring and cylinder wear.



self determined by a number of factors such as piston speed, effectiveness of jacketing (especially whether or not the heads are water cooled), whether all the cooling water passes through the head jackets or whether they are of the thermo-siphon circulating type, and last, but not least, the diameter of the compressor cylinder. It is clear that the ratio of jacket surface to cylinder volume becomes smaller as the cylinder size increases, so that the jacket efficiency becomes less and the compression line steeper or more nearly approaches the adiabatic.

It will thus be seen that, unless leakage is sufficient to raise the compression line as high or higher than the adiabatic line, there is no reliable indication as to the extent of leakage.

Piston-ring leakage has the effect of being less noticeable on the indicator card over the lower or early part of the compression line, and greater as the differential pressure on the two sides of the piston increases over the upper part of the curve. However, if there is also suction-valve leakage its effect is also not very noticeable during the early part of the stroke, but reaches a maximum during the latter part, so as to lower this part of the compression line. The same thing occurs with piston-ring leakage. Discharge-valve leakage, on the other hand, is greater during the early part of the compression stroke and less during the latter part, because of smaller pressure differential, and thus may nullify on the card any visible effect of piston-ring and suction-valve leakage.

With these several factors influencing the shape of the compression line and

A reliable way to test rings for leakage is to move the piston to mid stroke, block the flywheel, connect a pressure gage to the indicator cock and admit normal-pressure air to that end of the cylinder. A sudden pressure drop will indicate leakage past the piston rings. If the compressors are two stage, a check on the condition of the rings and valves can be made without an indicator by checking the air temperature and pressure at the intercooler. In

(*Continued on page* 156)

Q&A — QUESTIONS & ANSWERS FOR POWER ENGINEERS

By ALEX HIGGINS

5— *The Mechanics of Materials and Some Details of Boiler Construction*

Fifth in a series that is running in every number of POWER. *From long experience as a professional and practical engineer, Alex Higgins asks and answers some direct questions regarding power equipment—its construction, principle, maintenance, efficiency and safe operation. In outstanding fashion he drills the young power engineer, polishes up the oldtimer's knowledge, helps all comers pass engineer examinations and win certificates of higher grade. Besides being invaluable as a study course for examinations, it is a good review for the chief himself who wants to do a better job.—Editor*

Strength of Materials

Q 1—What is meant by load, stress, strain?

A—*Load* is an *external* force acting on a body. *Stress* is the *internal* resistance that the particles composing a body offer to the action of an external load. *Strain* is a change of length or shape caused by an external load. There are three kinds of simple stress and strain: (1) tensile stress and tensile strain, (2) compressive stress and compressive strain, (3) shearing stress and shearing strain. Tensile or compressive strain is measured by the fraction: change of length ÷ original length.

Q 2—If an iron bar 6 ft long and 2 sq in. in cross-section is subjected to a pull of 20,000 lb, and is stretched 0.024 in. in length what is the load, unit stress and strain?

A—Load = 20,000 lb.

Unit stress = load ÷ area = 20,000 ÷ 2 = 10,000 psi (pounds per square inch).

$$\text{Strain} = \frac{\text{increase in length}}{\text{original length}} = \frac{0.024}{72} =$$

0.00033 in. per inch. Note that this last answer means there has been an extension in length of 0.00033 in. per inch of original length.

Q 3—Explain what is meant by the following terms: tensile unit stress, compressive unit stress and shear unit stress.

A—*Stress* is the force acting within the material. *Unit stress* is the stress per square inch of cross-section. It equals the external load divided by the area that carries the load. Thus, *tensile unit stress* in a rod under tension is equal to the total tension in pounds divided by the square inches of cross-section. Likewise *compressive unit stress* in a short rod under compression is the total compressive force in pounds divided by the cross-sectional area in square inches.

Shear unit stress is the total shearing force divided by the area resisting that shear. *All unit stresses*, whether tensile, compressive or shear, are measured in pounds per square inch (psi). In Fig. 1, 2 and 3, the unit stress is the total force divided by the area subjected to tension, compression or shear. Although actual failure is pictured in each case, this merely suggests the type of failure that would occur if the type of stress listed were indefinitely increased. In Fig. 3, note the difference between single and double shear. In the latter case, the area carrying the load is double the cross-sectional area of the rivet, so each rivet does double duty.

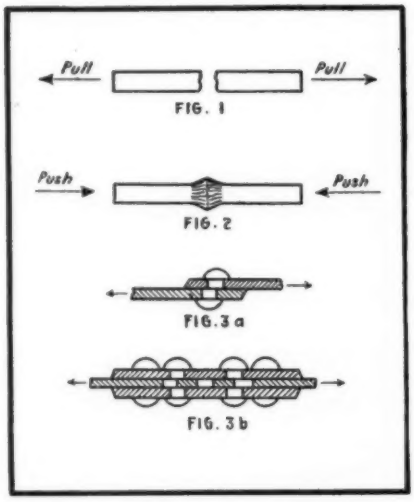


Fig. 1—Failure in tension. Fig. 2—Failure in compression. Fig. 3—Single shear (a) cuts a single cross-section of each rivet, while double shear (b) cuts two cross-sections and therefore withstands double the load

Q 4—What is meant by the elastic limit of a material?

A—If a tensile or pulling load is applied to a bar of metal, the bar stretches more and more as the load is increased, and for a while in exact proportion to the load. Finally, a load is reached at which the bar starts to stretch faster for a given increase in load. The unit stress at this point is called the *elastic limit* of the material. If a bar is loaded to less than the elastic limit, it returns to its original length after the load is removed. If it is stretched beyond its elastic limit, it retains a permanent "set" after the load is removed.

Q 5—What is the ultimate strength of a material?

A—It is the total load (in tension, compression or shear, as the case may be) required to pull the piece apart, to crush it, or to shear it, divided by the square inches of area resisting such failure. Since the cross-section changes before a piece fails in tension or compression, the material's ultimate strength is customarily figured as the breaking load divided by the *original* cross-section.

Q 6—Is there any difference between the strength of a piece and the strength of the material of which it is made?

A—If a certain steel has tensile strength of 60,000 psi, a particular bar of 4 sq. in. in cross-section has a strength of 240,000 lb. The same applies to elastic limit and to actual loads. In each case we may consider the *total* loading for an *object*, such as a bolt or a rivet, but only the unit stress (loading per sq in.) in the case of a *material*.

Q 7—What is meant by the safe working strength of a material?

(*Continued on page* 116)

ALL REVERE ADMIRALTY CONDENSER TUBES ARE OF THE ARSENICAL TYPE

Advantages of Arsenical Admiralty Condenser Tubes

in inhibiting tube failure due to "dezincification"

Revere early recognized the need for an Admiralty Condenser Tube specially designed to help prevent the peculiar type of corrosion called "dezincification."

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★ *A reprint of a paper presented to the Tenth Mid-Year meeting of the American Petroleum Institute, by R. A. Wilkins, Director of Revere Research, entitled "Corrosion of Copper and Copper-Base Tubing in Oil Refinery Heat-Transfer Equipment" will be gladly sent on request.*

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Q&A FOR POWER ENGINEERS

(*Continued from page* 114)

A—This is the maximum unit stress deemed safe for a material to carry under ordinary working conditions. To provide a sufficient margin of safety, it is always far less than the elastic limit, which in turn is much less than the ultimate strength.

Q 8—What is the factor of safety?

A—It is the ultimate strength of the *material* divided by the *actual unit stress*, or it is the ultimate strength of the *piece* divided by the actual total load (tension, compression or shear) on the piece. Thus, it is merely a number showing how strong the material or object is in terms of the imposed load: If the factor of safety is five, the load would have to be multiplied five times to break the piece.

Factor of safety must allow for uncertainties in the uniformity of the material, for corrosion and wear, for bumps and jerks, for fatigue, for overloading and for imperfections in the method of figuring.

Thus, in practice, for each kind of work and material, the factors used are those experience shows to be reasonably safe without undue waste of material from making parts overly strong.

Q 9—What working steam pressure psi is allowed on a steam boiler whose bursting pressure is calculated to be 1260 psi if safety factor is 5.6?

A—Note that the stress in the metal is unknown as far as this problem is concerned. Only the bursting steam pressure is given. However, stress in the metal is proportional to the steam pressures, so you merely divide 1260 by 5.6 to get 225 psi, the safe working steam pressure.

Q 10—A steel bolt carries a load that induces a unit stress of 6000 psi. What is the ultimate strength of the bolt material if a safety factor of 8 is used?

A—Ultimate strength = working load × factor of safety = 6000 × 8 = 48,000 psi.

Q 11—If steel bars with an ultimate tensile strength of 56,000 psi are used to make boiler stays and the maximum permissible stress is 8000 psi, what factor of safety is being used?

A—Factor of safety = ultimate tensile strength ÷ maximum permissible stress = 56,000 ÷ 8000 = 7

Q 12—What is the ultimate strength of a round steel bar, 1½ in. in diameter, if steel's breaking strength is 60,000 psi?

A—Area of bar = 0.785 × 1.5 × 1.5 = 1.77 sq in. Ultimate strength = 60,000 × 1.77 = 106,200 lb

Q 13—What is the stress in six 1-in. bolts that support a load of ten tons? Diameter at bottom of threads is 0.84.

A—Total area of bolts = 6 × 0.84 × 0.84 × .785 = 3.32 sq in.

Stress = load ÷ area = (10 × 2000) ÷ 3.32 = 6024 psi

Q 14—What tests are applied to material that is used to manufacture a steam boiler, and what are the purposes of these tests?

A—*Tension* test: to find ultimate tensile strength of a material and amount of elongation when subjected to varying degrees of tensile stress.

Crush test: applied to boiler tubes to see whether they can stand crushing longitudinally without cracking.

Bend test: to find whether metal stands bending without breaking or cracking.

Flattening test: ability of part, when it is under test, to stand flattening without cracking.

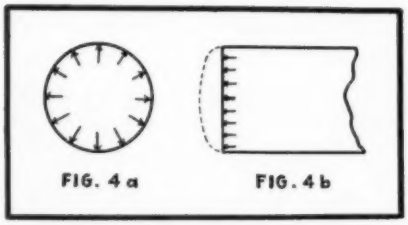

Fig. 4—A cylindrical shell (a) maintains its shape under internal pressure, but a flat head (b) tends to be pushed out into an elliptical shape

Transverse test: resistance of metal to bending.

Homogeneity test: to find whether the internal structure of metal is uniform by examining the broken edges of a fractured specimen.

Fracture test: same purpose as homogeneity test.

Nick bend test: same purpose as homogeneity test.

Etch test: examining structure of material by polishing the surface of the test specimen and etching the polished surface with acid.

Hardness test: for surface hardness.

Hydrostatic test: water-pressure test applied to pipes, tubes and castings to detect weak parts in structure. Also applied to finished boilers and other pressure vessels to find weaknesses in material or defects in workmanship.

X-ray test: to examine castings and welds for possible flaws.

Q 15—Why are the principal parts of boilers subjected to internal pressure usually cylindrical in form?

A—In a cylindrical vessel pressure is exerted equally in every direction on the cylindrical surface and thus no part tends to become distorted through excessive pressure. See Fig. 4a. In 4b, pressure is shown acting on the flat head of a cylindrical shell. Edges of the flat plate are supported by the shell plate, but the center of the plate is not supported in any way and tends to bulge outward in an elliptical form, as the dotted line shows. Elliptical-shaped heads, such as those in many types of watertube boiler drums, do not require support because they are already in the shape to which a flat head would be distorted by excessive pressure. On the other hand, flat plates *must* be stayed.

Q 16—How are boiler plates joined?

(*Continued on page* 118)

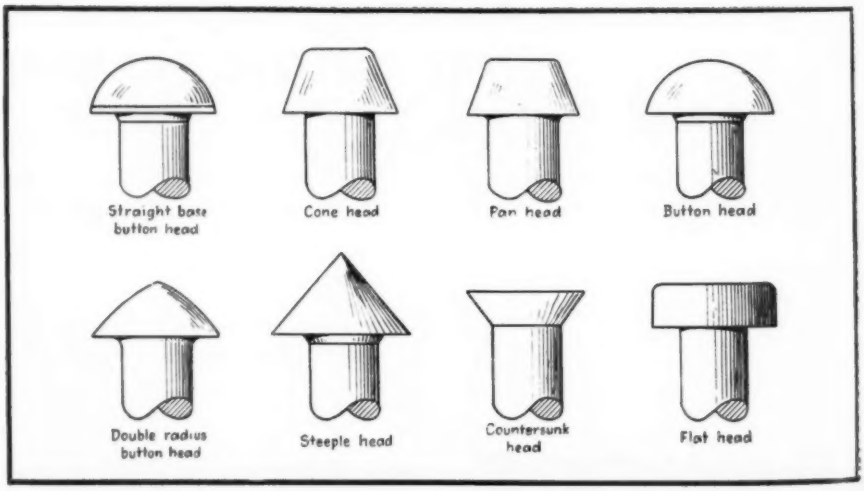

Fig. 5—Some rivet heads that are used in boiler construction

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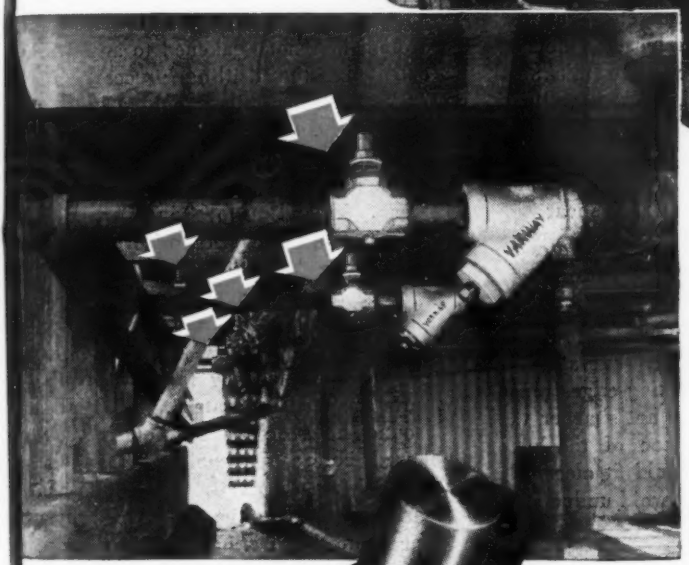

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YARWAY IMPULSE STEAM TRAP

Q&A FOR POWER ENGINEERS

(*Continued from page* 116)

A—By riveted or welded joints.

Q 17—What forms of rivet heads are allowed in boiler construction?

A—Various acceptable forms of rivet heads are shown in the *ASME Code for Power Boilers*, also in Fig. 5, page 116.

Q 18—What forms of riveted joints are used in boiler construction?

A—Lap joints and butt joints. In the lap joint, edges of plates overlap. In the butt joint, plate edges meet or "butt" together so that cover straps are used.

Q 19—Describe and sketch a single-riveted lap joint.

A—In this joint, plate edges are lapped over and secured by one row of rivets. Fig. 6 shows a side view and end sectional view of a single riveted lap joint.

Q 20—Describe and sketch a double-riveted lap joint.

A—In this joint, plate edges are lapped and secured by two rows of rivets, Fig. 7.

Q 21—Describe and sketch a double-riveted butt joint with double straps.

A—In this joint, plate edges are butted together and cover straps are placed inside and outside. Fig. 8 shows a double-riveted double-strap joint with straps of equal width.

Q 22—Describe and sketch a triple-riveted butt joint with double straps of unequal width.

A—In this joint, Fig. 9, plate edges butt together and cover straps are placed inside and outside, but the outside strap is narrower than the one inside. Outer rows of rivets pass through inner strap and shell plate but not through outer strap, and alternate rivets are omitted in these outer rows.

Q 23—Why is a butt joint preferable to a lap joint?

A—In the butt joint, shell plates form a true circle and there is no tendency for the pressure to distort the plates in any way. In the lap joint, plates do not form a true circle at the lap and internal pressure tends to pull them to the position shown in Fig. 10. In time, this bending action may cause "grooving" or cracking of the plate along the calking edge and thus create a dangerous condition. Properly designed butt joints also have much higher efficiencies than lap joints with the same number of effective rows of rivets, because in the butt joint all or most of the rivets pass through three plate thicknesses and so are in *double shear*, while the rivets in lap joints are all in single shear. According to the ASME Code, rivets in double shear have twice the strength of rivets in single shear.

Q 24—What preparation of plates and butt straps is necessary to insure good riveted joints?

A—Plates and straps must be rolled or formed to the proper curvature by pressure only and calking edges planed or milled to an angle not sharper than 70 deg with the plane of the plate. Plates and straps should fit closely before riveting so as to avoid undue stress on the rivets or excessive calking to make a joint tight.

Q 25—Should rivet holes be punched or drilled?

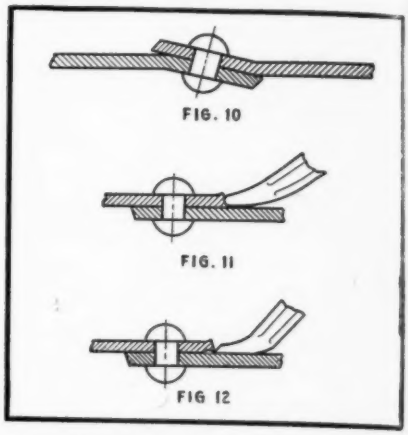

Fig. 10—Distortion of lap joint. Fig. 11—An example of good calking. Fig. 12—Poor calking

A—A drilled hole is best because it is parallel, exact in size, and the metal around it is not weakened to any great extent by the drilling process. The ASME Code permits punching holes at least ⅛ in. less than full diameter in plates not over ⅞ in. thick, and at least ¼ in. less than full diameter in plates over $\frac{7}{16}$ in. and up to ⅝ in. Drilling or reaming to full size removes metal around the hole that may have been crushed by the action of the punch.

Final drilling or reaming of rivet holes is done with the joint assembled and held in place by tack bolts. The parts are then separated and all burrs around holes, chips and cuttings removed before reassembling the joint and driving the rivets. Tack bolts and barrel pins keep the holes in proper line while the riveting is being done.

Q 26—What is calking and why is it necessary?

A—Calking refers to the upsetting or burring up of the edge of the plate or strap after riveting, so as to make the edge press down tightly on the plate beneath and thus form a water- and steam-tight joint. This is necessary because inequalities in the plate surface make it practically impossible for riveting alone to make a joint absolutely tight. In calking, use a blunt-nosed tool and take great care not to damage or nick the bottom plate. A blunt or round-nosed tool thickens the plate edge, as in Fig. 11, but a sharp tool may actually force the plates apart, as in Fig. 12, and so do more harm than good. After calking and applying the hydrostatic test, certain seams may be seal welded as a further precaution against leakage.

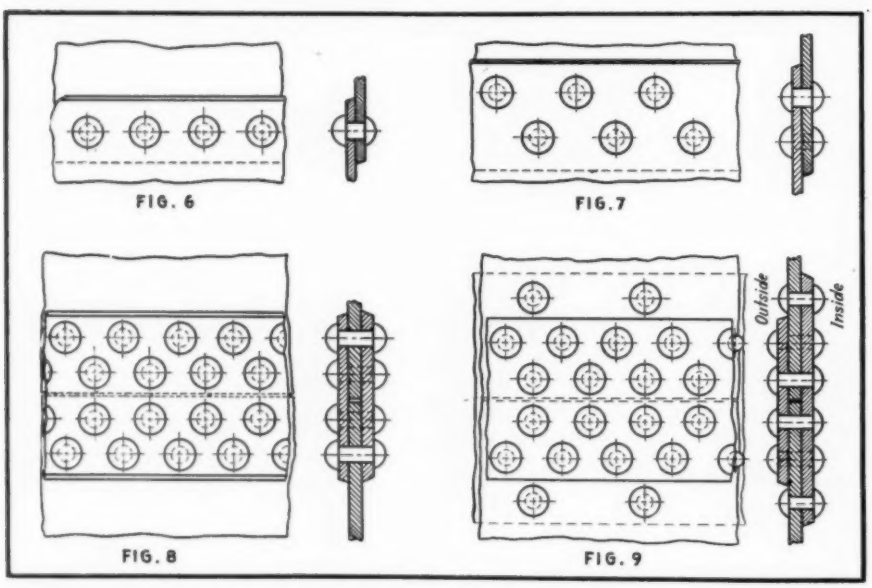

Fig. 6—Single-riveted lap joint. Fig. 7—Double-riveted lap joint. Fig. 8—Double-riveted double-strap butt joint. Fig. 9—Triple-riveted double-strap butt joint

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Making the most of present equipment—speeding production while reducing repairs—is a vital part of America's war program. This knowledge kept one ice plant switching from oil to oil in an effort to find the most efficient lubricant for their ammonia compressor—one that would save precious time by preventing costly shutdowns.

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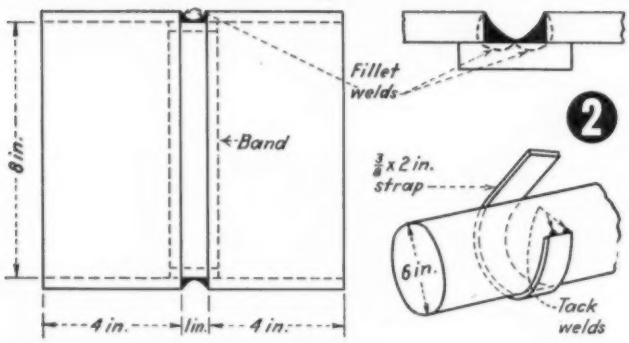
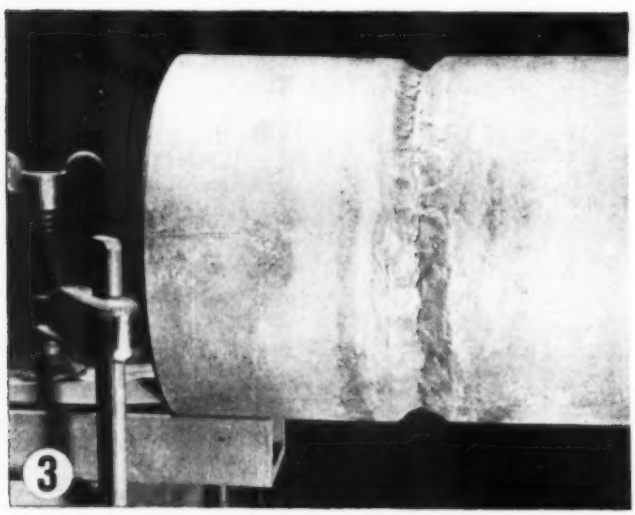
HOW TO LEARN TO MAKE POSITION WELDS

This is the fifth of a series teaching the basic elements of pipe welding, for beginners and for experienced welders who want to break in new men. Refer back to April POWER *(page 126) for list of materials and preliminary instructions. Pictures and data by courtesy of Linde Air Products Co.*





1 First prepare to position-weld two 6-in. lengths of 6-in. pipe. Bevel ends as described in April POWER, clean off oxide, line up pipe in angle iron, and make three shallow tacks in bottom of vee. Place tack-welded lengths of pipe in a piece of 3-in. channel, insert an iron bar in the pipe, and clamp bar and channel to welding table so that pipe is held rigid and vee extends beyond end of channel enough to permit welding underneath (see Fig. 3). Start welding at bottom, with blowpipe flame pointing almost straight up and with welding rod inclined at an angle. This position, taken from below looking upward, is shown in Fig. 1. Photos and diagram of Fig. 4 show how angles between blowpipe, rod, and work change as welding continues around pipe.

First close bottom of vee and then fill up entire vee with one pass. Keep molten puddle as small as possible. Heat edges for some distance ahead of weld, but do not melt them. Keep end of welding rod in puddle; do not lift it out and do not stir. Flame force and tendency of thin layers of molten metal to adhere to overhead surfaces that are just hot enough to stay molten will hold puddle in place and it will not drip off as might be expected. If puddle appears to be getting out of control, flick flame away momentarily, permitting molten metal to solidify slightly.

In addition to the exercises described thus far, the American Welding Society's qualification tests include making a position weld in 8-in. pipe with ends beveled as shown in April POWER. This is executed in the same fashion as the weld in 6-in. pipe just described

2 Now prepare to make a fillet weld in 8-in. pipe by spacing square-cut ends of two lengths of pipe about 1 in. apart and inserting a band on inside of pipe beneath this gap, as shown in Fig. 2. Make band by tack welding end of a ⅜x2-in. steel strap to side of a 6-in. pipe. Heat strap with blowpipe and bend it around outside of pipe. Melt out tack weld. Band will just about fit inside of 8-in. pipe after springing outward. Tack weld one end of each length of 8-in. pipe to band, making three tacks

3 Clamp tacked pieces in channel, as shown in photo. End of each pipe is to be fillet-welded to band, welding being done with pipe in position. Start welding at bottom and work around one side to top; then go back to bottom and weld around other side to top. Close root of fillets for about ½ in., or a little less, and then fill in with welding rod to required contour (see photo). Hold blowpipe and rod in about same relation to pipe as in making overhead and fillet welds described and illustrated in June POWER, page 120

CONTINUED ON PAGE 122

the medicine man was a humbug

Photo in Nalco Laboratories

THE medicine show was a lucrative racket but science and education have run it pretty well into the ground.

There is no cure-all for human ills and there is no one-shot remedy for water treatment problems. Nalco maintains the world's finest water treatment laboratories for developing the right treatment for each and every problem. From these laboratories have come many original developments which benefit Nalco customers. For permanent and unvarying results, call the Nalco man today. You'll be glad you did.

NATIONAL ALUMINATE CORPORATION

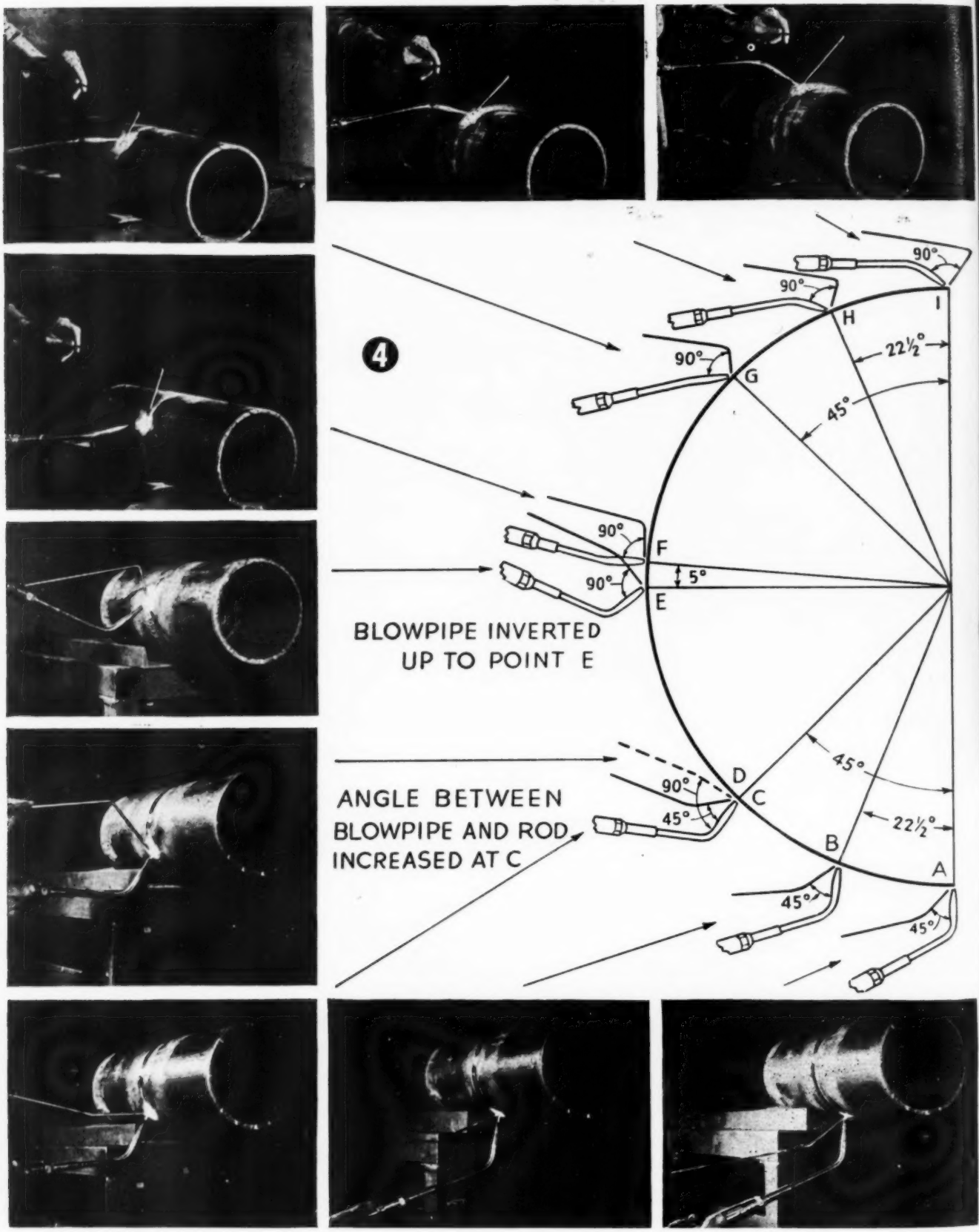
6222 West 66th Place **Chicago 38, Illinois**

Canadian inquiries should be addressed to Aluminate Chemicals, Ltd., 555 Eastern Avenue, Toronto, Ontario

nalco

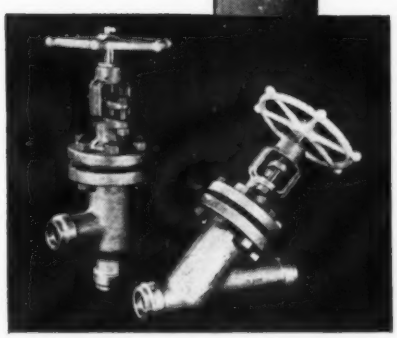
The Complete Water Treating Service

Continued from page 120)

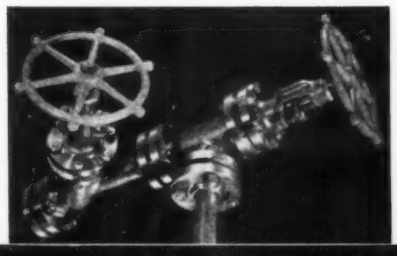


4 **Diagram and photos above show that in position welding blowpipe takes an inverted position until one-quarter of weld has been made, to *E*. Blowpipe then takes normal position. At *E*, blowpipe tip points slightly upward; at *F* it is almost horizontal and, as welding progresses, head angle gradually approaches that of normal downhand position, *I*. Practice with blowtorch unlighted to acquire knack of moving flame and rod**

EDWARD *Blow-off* VALVES



Built with both socket welding ends (above) or flanged ends (below) Edward blow-off valves have a minimum of internal parts. Hence less clogging, erosion, adjustment or replacement.



CONTINUED TIGHT CLOSURE

Nothing is more important in a blow-off valve than tight closure over long periods of operation.

That's why Edward blow-off valves are of globe type seating design. That's why, too, the materials used in their manufacture have been carefully selected so that the coefficients of expansion are such that a valve closed tight under high boiler temperature will still be tight when cool.

For any power plant, marine, oil field boiler or process piping service from 150 to 1500 lb sp service, specify Edward. The choice of straightway or angle design makes possible a wide variety of installation combinations to meet space limitations. The Edward Valve & Mfg. Co., Inc., 1220 West 144th Street, East Chicago, Indiana.

EDWARD Steel VALVES

ENGINEERS' BOOKSHELF

Refrigeration

REFRIGERATING DATA BOOK — (Fifth Edition — 1943) — *By editor-in-chief David L Fiske, secretary of The American Society of Refrigerating Engineers and many other well known engineers in this field. Published by the American Society of Refrigerating Engineers, 50 West 40th St, New York City. Text covers 510 pages with an advertiser's catalogue and other sections covering 160 additional pages, 6½x9 in., illustrated, tables, curves. Price $4.00.*

Editions of Refrigerating Data Book were published in 1932, '34, '36, '39 and 1941. The 1941 edition was designated Vol. 2 as a companion to the 1939 book Vol. 1. With this edition the former plan of a single volume is undertaken, but the information relating to refrigeration applications appearing in Vol. 2 has not been included. Thus this book is virtually a revision of the 1939 edition, covering basic principles and data, the refrigeration cycle and the major kinds of refrigerating and air conditioning machinery.

All data present practical information based on current practice including the latest refrigerant tables giving refrigerant characteristics down to temperatures as low as —100 F. Theoretical explanations of refrigeration and air conditioning principles are presented with analyses, examples, problems, solutions and illustrations. This book is well adapted for the advanced student as well as for reference purposes.

Approximately 50% of text space is filled with valuable tables, curves and charts. A few of the many subjects covered include types of refrigeration systems; properties and tables of refrigerant and brines; heat transmission, insulation, load calculation and theory of freezing; all kinds of compressors, evaporators, piping and controls; domestic and commercial refrigerators; air conditioning theory and calculations; fans and ducts, cooling towers and refrigeration control.

REFRIGERATION THEORY AND APPLICATIONS—*By H G Venemann, Associate Professor of Refrigeration, Purdue University. Published by Nickerson & Collins Co, 435 N Waller Ave, Chicago, Ill. 264 pages. 8½x11 in., 66 illustrations, 41 tables, 13 fold-in inserts, flexible binding. Price $3.50.*

The subject is presented as a complete treatise on the fundamental prin ciples involved in processes of refrigeration with typical applications to assist the student and engineer to design and operate plants. One of the principal features of this book are the problems presented at the end of each chapter. This makes it easy for the reader to examine himself on each individual subject.

The book is written in a series of lessons covering individual subjects such as the different methods of refrigeration, cooling the refrigerant, compression and condensation, refrigerants, and the theoretical compression cycle.

Continuing to mechanical equipment the author discusses compressor characteristics and the influence of variable loads on compressor performance, all types of heat exchangers and automatic load control. The final chapter is devoted to specifications for refrigeration equipment to serve a modern locker plant.

This book also contains a pressure-temperature relationship curve of refrigerants, a Mollier chart of Ammonia Properties and Pressure-Enthalpy charts for Freon 11, Freon 12, Freon 21, Freon 113, Methyl Chloride, Sulphur Dioxide, and Dry Air.

Electronics

ELECTRONIC CONTROL RESISTANCE WELDING (1943). *By George M Chute, application engineer, General Electric Co. Published by McGraw-Hill Book Co, 330 W 42nd St, New York, N. Y. 389 pages, 6x9 in.; illustrated; cloth binding. Price, $4.*

Too many books on electronics have been written by those who do not understand the practical worker's problems.

(*Continued on page* 166)

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You will help us give you the good service that is your due by notifying us at once of your change of address. Often the monthly issues of POWER go out of print almost immediately after publication, preventing us from supplying issues that may have been misdirected. Prompt notification of address changes that have been made or will be made prevent your missing a single one of the big valuable monthly issues of POWER.

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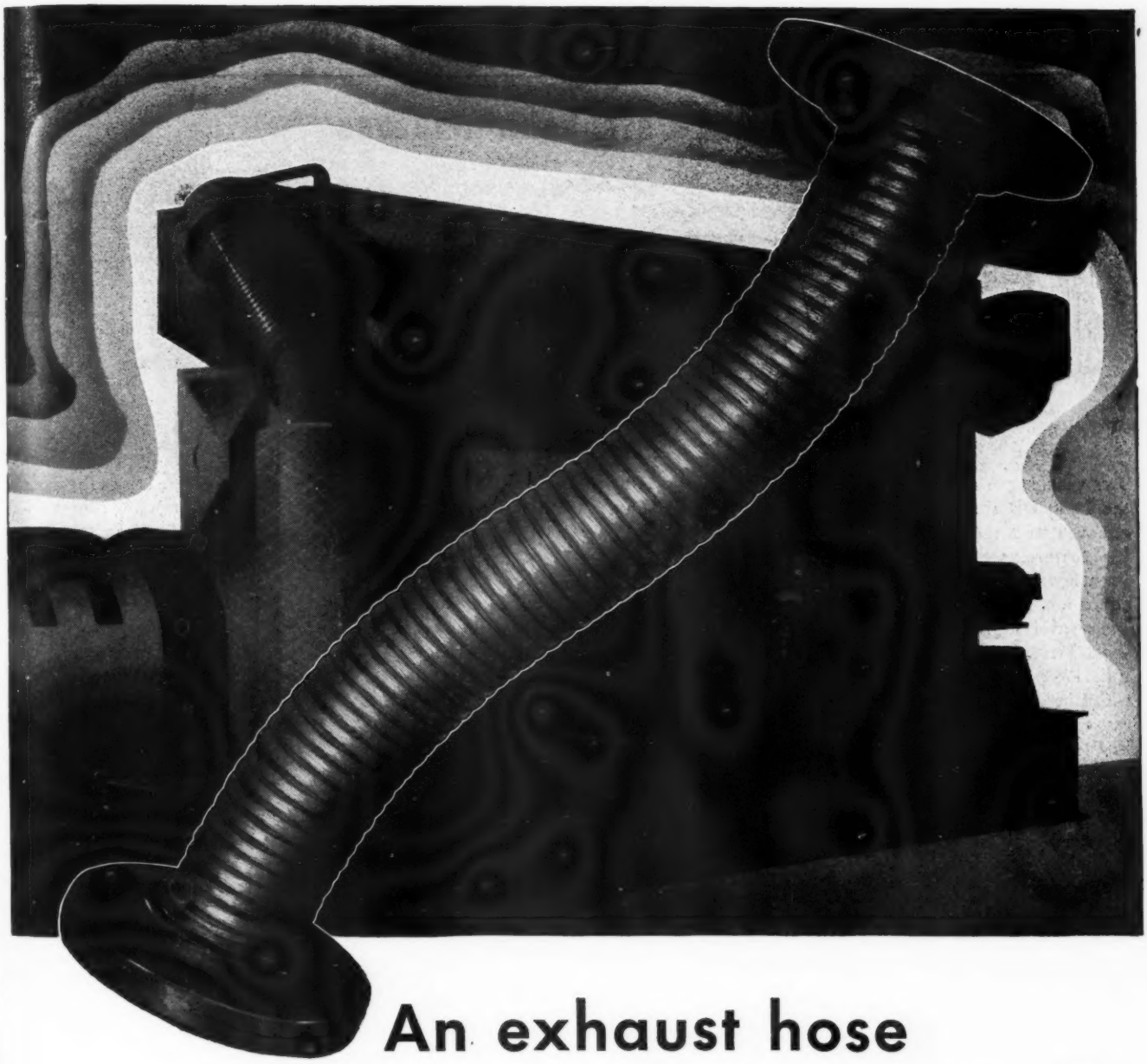


An exhaust hose that isn't easily "exhausted"

Once installed, American Diesel Engine Exhaust Hose stays on the job for years . . . absorbing vibration, providing permanent tightness against seepage, deadening noise, compensating for expansion and contraction caused by the terrific temperature changes encountered in exhaust lines.

Here's why American stands up so well in this unusually severe service: essentially this hose is a flexible pipe. Made of heavy galvanized steel, it is spirally wound so that each convolution becomes fully interlocked with the next. A continuous packing, fed into a prepared groove, insures permanent tightness. And because it's flexible, it's easy to install. American also furnishes flexible metal tubing for fuel, air and starting lines on Diesels.

In addition to Diesel duty, many other types of American Flexible Metal Hose and Tubing serve war industries with distinction, some by conveying oil, steam, gas and water; others as a vacuum service for removing filings and dust, as protective armor and to shield electric wires, and in a thousand and one other important applications.

Whatever your needs in metal hose or tubing, you'll likely find one in the American line that will help you do the job just a little bit better. Your inquiries are invited. 43201

American Interlocked — wound of strip metal, joints packed; the toughest type of extremely flexible metal hose.

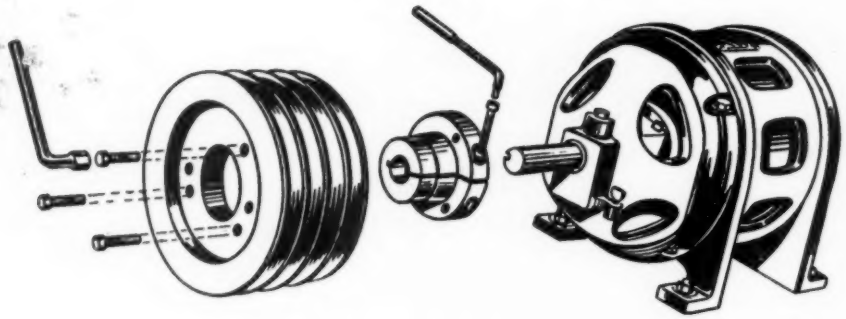
AMERICAN METAL HOSE BRANCH OF THE AMERICAN BRASS COMPANY
General Offices: Waterbury, Connecticut
Subsidiary of Anaconda Copper Mining Company
In Canada:
Anaconda American Brass Ltd., New Toronto, Ont.

ANACONDA from mine to consumer

American Metal Hose

WHAT'S NEW IN PLANT EQUIPMENT

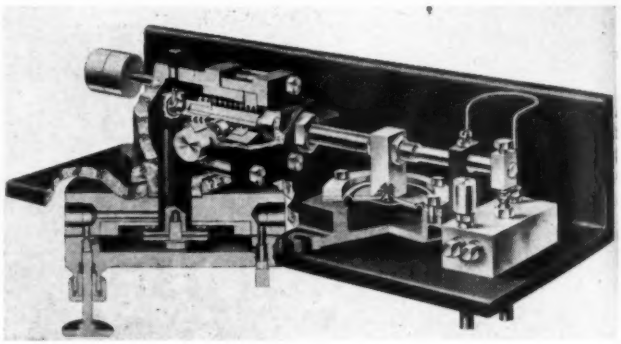
Quick-Detachable Sheaves



THE EASE, SPEED AND SAFETY with which the Pyott QD sheave is attached to or removed from the shaft is its outstanding feature, maker states. A socket wrench is the only tool needed for either job. Illustration shows the simple steps involved in attaching sheave to shaft. First step is slipping the tapered, split Pyott hub onto the shaft in line with the keyway. Then the headless capscrew is tightened down with an inserted key, clamping the hub firmly on the shaft and producing a virtual press fit, even on undersized or oversized shafts. Next step is attachment of the sheave on the tapered hub. Actual tightening of the sheave on the hub is accomplished by inserting the pull-up bolts shown in the illustration and tightening them evenly with a socket wrench. These bolts protrude through the sheave and engage with threaded holes in the hub to form an immovable union. Removal of the sheave from the hub is equally simple. First step is to unscrew the pull-up bolts and then insert special pull-up bolts in special tapped holes in the sheave and tighten them down. As they emerge through the opposite side of the sheave the pull-up screws act as jack screws to force the sheave away from the hub, safely and smoothly and without hammering or rough handling. *Pyott Foundry & Machine Co, 328 No Sangamon St, Chicago, Ill.*

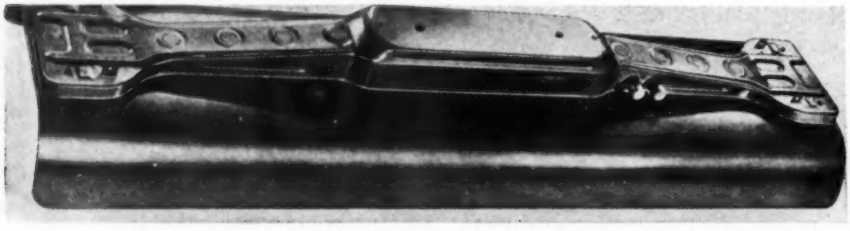
Pressure Transmitter

PNEUMATIC DIFFERENTIAL pressure transmitter is for measuring flow and level. Pneumatic device converts a differential pressure such as is produced by the flow of a fluid through an orifice, or by liquid level in a vessel, into an air pressure which varies proportionately with the differential pressure. Ranges are available from 0.9 to 25 in. of water differential for working pressures up to 16 psi; 750 in. of water for working pressures up to 25 psi; and 13 to 800 in. of water for working pressures up to 600 psi. Company reports that the effect of ambient-temperature variation on the accuracy of the new transmitter is negligible. *Republic Flow Meters Co, Chicago, Ill.*



Lighting Fixture

SYLVANIA INDUSTRIAL FLUORESCENT lighting fixture meets WPB material weight requirements. First unit designed to operate two or three 40-watt lamps, will be shortly followed by a companion unit for a pair of 100-watt fluorescent lamps. Fixture has a non-metallic reflector, finished on the outside in industrial French gray and has a reflecting surface of company's own Miracoat. Reflector is anchored to the top housing with two latches which release with a simple quarter turn, yet lock compactly. *Sylvania Electric Products, Fluorescent Fixture Div, Ipswich, Mass.*



Coil-Turn Counter

AN IMPROVED COIL-TURN COUNTER for laboratory or factory use in determining with precision the number of turns in wound electric coils announced. The new counter is more compact in design and incorporates a magnetizing current control box which greatly simplifies the installation. The counter is capable of checking or determining the effective turns of coils ranging from 1 to 11,110 turns at a rate of from 80 to 100 coils of like specifications per hour. The operation of the counter is simple. The coil to be tested is

(*Continued on page* 172)

NEW WARTIME CATALOG SERVICE ON CRANE PIPING PRODUCTS . . .

Shows at a glance all items obtainable and those not being made under Simplification program of National Bureau of Standards. Saves time for piping maintenance men, specifiers, buyers.

WHAT'S BEING MADE AND WHAT ISN'T

IT'S basic home front strategy—simplification of lines. It is conserving vital materials and allowing greater production of most essential products. It enabled Crane, for example, to double and re-double the output of necessary valves and fittings for the Army, Navy, and war industries.

But to keep production lines flowing, piping men must know what equipment is being made and what isn't. Regular catalogs become quickly obsolete. So—to save time for maintenance men, specifiers and buyers, and make their jobs easier, Crane has introduced this novel cataloging service on piping products under the Simplification program.

With an individual section for each class of product, innovation of this catalog service is that its pages are reproductions from the latest Crane general catalog, but with special markings instantly showing all products eliminated as well as those available. Noteworthy is that Crane still offers the broadest selection of valves and fittings for every service.

Most plants have these emergency catalogs. Under present operating conditions, their regular usage offers many important benefits. You can depend on them for the accurate specifications, application and ordering data necessary to keep pipe lines flowing for Victory. Crane Co., 836 S. Michigan Ave., Chicago, Ill.

ARMY E NAVY

CRANE VALVES

QUESTION FOR AMERICANS . . .

What did you do for Freedom today?
A Marine on Guadalcanal,
Through a hail of lead and jungle hell,
Crept out to a wounded pal;
And he dragged him back through the slime and muck,
Then, with never a thought of rest,
Back over that deadly route he went
And smashed a machine-gun nest.
It wasn't much fun—the bullets—the mud—
He may have been scared, but he hid it;
He only knew of a job to do
And he didn't quibble, he did it.
What did you do for Freedom today?
"All that you could." Think well—
One-millionth as much as that Leatherneck did?
—They buried the boy where he fell.

What did you do for Freedom today?
A Gob on a rubber raft
Drained the last wet drop from his water flask
Then threw it away and laughed.
For eighteen days on an endless sea
In a torment of pain he lay;
Drenched and chilled to the bone at night,
And burned to a crisp by day.
He wanted to live, but he knew in his heart
That the odds were a thousand to one;
But he drifted and hoped, consoled by a prayer,
And the thought of a job well done.
What did you do for Freedom today?
"All that you could," you declare.
But when you say it, remember the Gob
Who died on the raft out there.

What did you do for Freedom today?
Nine lads in a B-17
Ran into a flock of Messerschmitts
And died in their wrecked machine.
Oh, they didn't do bad with what they had,
But they flew through hell to do it;
They had smashed Berlin and a dozen "one-ten's"
But their number was up and they knew it.
They were full of holes, with no controls,
And their ship was a comet of flame;
But they stuck to their guns and the useless stick
And battled on just the same.
What did you do for Freedom today?
"All that you could." O.K.;
But if those nine boys in the B-17
Were to ask you, what would you say?

What did you do for Freedom today?
I think they've a right to ask.
You're in this fight just as much as they,
And with just as important a task.
Were you at your desk, or bench, or press,
And at work at the starting bell?
Did every minute of this day count?
And the job—did you do it well?
Did you buy a Bond or a Stamp today?
Or collect any scrap for the pile?
Did you save your grease or throw it away?
Did you drive just an extra mile?
Have you been down to the Red Cross Bank
And given a pint of your blood?
Did you send that V-mail letter today?
Did you hoard any rationed food?
Before you begin to complain and gripe
That life is all work and no fun—
Would you trade your dinner for Ration K?
Or your overtime pay for a gun?
Just stop every once in a while today
When your lot seems hard and lean,
And think of a Gob, and a Leatherneck,
And nine boys in a B-17.

—R. L. NICHOLSON.

The author, a war worker at Wolf Creek Ordnance Plant, Milan, Tenn., wrote this poem for the plant's employee bulletin. It was reprinted in *This Week* magazine and has since appeared in many other publications. I consider it a privilege to bring it to you—a simple, calm, but realistic demand for an accounting of every American conscience.

George Edwards
Engineer

IF YOU WANT TO CUT DOWN ON RE-PACKING... BETTER TRY SEA RINGS!

JM
No. 1
PACKING
for RODS and
PLUNGERS
• With virtually the entire production of J-M Packings and Gaskets needed for war, delivery on other than high-priority orders may be slower than in normal times. However, through increased capacity and round-the-clock production, every step is being taken to assure the fastest delivery possible under the present emergency.

It's not packing— it's RE-packing that's really expensive... that's why it pays in dollars and cents to use the best packing money can buy. J-M Sea Rings are that kind of packing.

They're custom-made to fit specific operating conditions. Entirely automatic, they seal on the work stroke, release on the return, thus reducing friction and wear on both packing and rod. During the past 25 years many engineers have accepted Sea Rings as the standard packing for reciprocating rods and plungers operating against steam, water, air, brine, oil, gasoline and many other fluids and chemicals.

For details on J-M Sea Rings and the complete line of J-M Packings and Gaskets, write Johns-Manville, 22 E. 40th St., New York, N.Y.

JM PRODUCT

Johns-Manville PACKINGS & GASKETS

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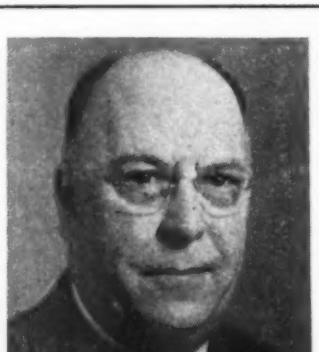
POWER LINES

Personal notes, items of general interest, the latest from Washington:—all the news that is news in the power field



Nevin E Funk, vice-president in charge of engineering, Philadelphia Electric Co, was elected president of the **American Institute of Electrical Engineers** for the year beginning Aug 1, 1943, as announced at the annual meeting of the Institute held in Cleveland, Ohio, during the Institute's technical meeting.

OBITUARIES

William B Gillies, vice-president in charge of operations of the **Youngstown Sheet and Tube Co,** died on June 20, following a heart attack. Mr Gillies began his career in the steel industry immediately after his graduation from college as foreman for Illinois Steel Co, and served in this capacity from 1904 to 1907. From 1907 to 1913 he was superintendent of the Bessemer department of the South Works of the Illinois Steel Co. From 1929 to 1933 he was assistant vice-president in charge of operations of the Youngstown Sheet & Tube Company, and from 1933 until his death was vice-president in charge of operations.

Earle D Parker, 63, vice-president and general works manager of the **Barber-Colman Co,** died June 13, 1943. For 40 years Mr Parker had been employed in the engineering and management divisions of the company, and for the past 20 years had served as general works manager. He became vice-president of the firm following the death of Howard D Colman, president.

Dr Stanley E Coulter, former dean of men and dean of science at Purdue University, died June 26 at the age of 90, and **Dr Gilbert A Young,** one time

(*Continued on page* 196)

The Benjamin Garver Lamme Medal, awarded annually by the American Institute of Electrical Engineers for meritorious achievements in the development of electrical apparatus or machinery, was presented recently to **Dr Joseph Slepian,** associate director of the Westinghouse Research Laboratories. Dr. Slepian, one of the nation's leading mathematicians and physicists, was selected as the 14th winner of the Medal for his contributions to the development of current interrupting and current rectifying apparatus. He developed the ignitron, an electronic tube now being used to convert alternating electric current into direct current, and he is also noted for his work on circuit breakers.

o o o

Westinghouse Centralizes Electronic Applications

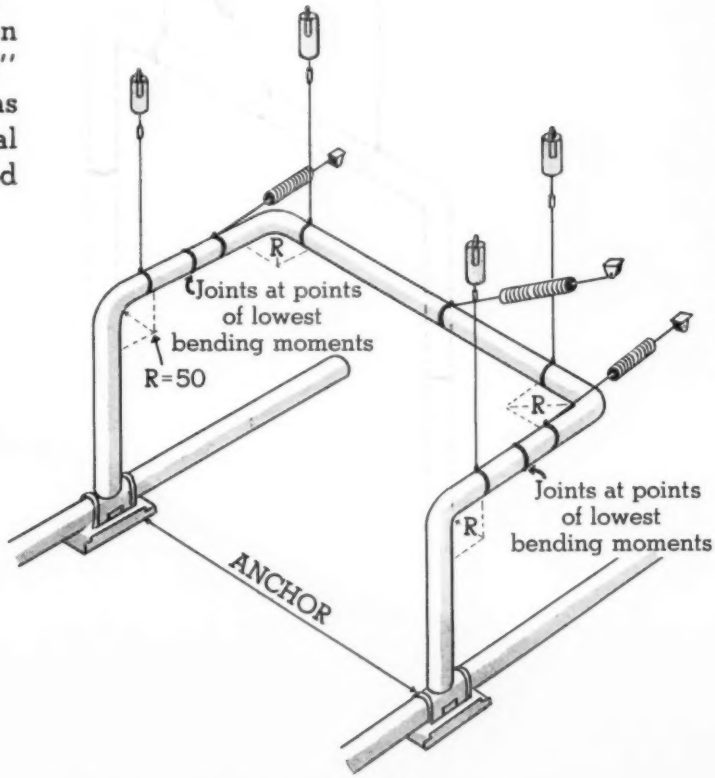
To promote the use of electronics in industry on a broad engineering and commercial basis, Westinghouse Electric & Mfg Co has established a group of electronic engineers who will guide and direct the industrial, central-station and transportation electronic applications. This new central organization will supplement the company's present electronic divisions with specialized activity such as control, radio, lamps, and power conversion. This was announced at a luncheon for technical editors, July 7, in New York.

This step in centralization has been taken to accomplish three primary objectives: first, to expedite present wartime applications of electronic devices; second, to be able to utilize to the fullest extent the present developments for post-war applications; third, to make immediately available to all other industries the developments and improvements found practical in one industry. The various industry engineering sections will retain the responsibility for making specific applications within their industry. This new central organization will act as consultants and coordinate the efforts on new developments pertaining to the electronic methods of doing specific jobs.

Typical electronic control job in industry is holding motor speed constant at any preset value. Electronic speed regulators have extreme sensitivity. Operation is automatic; there are no moving parts, no friction. This single motor drive for a big paper mill uses an electronic regulator to hold speed constant.

THE SCIENTIFIC APPROACH TO YOUR PIPING PROBLEMS

One example of "Scientific Approach to Piping Problems," illustrates a suggestion for a two plane "U" bend as a simplified as well as an economical design for low head room conditions.



Spring assemblies are all of the same length at the same elevation away from interconnecting piping, valves, covering, etc., presenting a remarkably neat appearance.

Functional Hangers and Vibration Eliminators permit unrestricted line movement. Exclusive features allow swivel action in all directions and eliminate metal fatigue.

POWER PIPING DIVISION presents the ultimate in ENGINEERING • PREFABRICATION • ERECTION

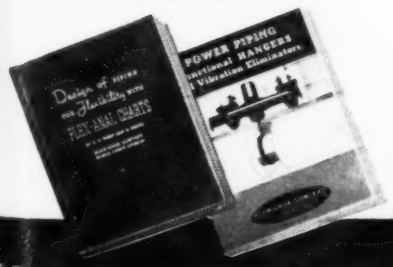
- **Engineering**
- **Prefabrication**
- **Erection**

The employment of FLEX-ANAL CHARTS* enabling engineers to simplify and quickly arrive at an economical design.

All sub-assemblies are completed under rigid engineering control. This results in a negligible amount of field welding and simplifies erection.

Highly developed procedures employed provide the last word in economical erection. The use of Functional Hangers and Vibration Eliminators adequately control the behavior of your piping system.

A



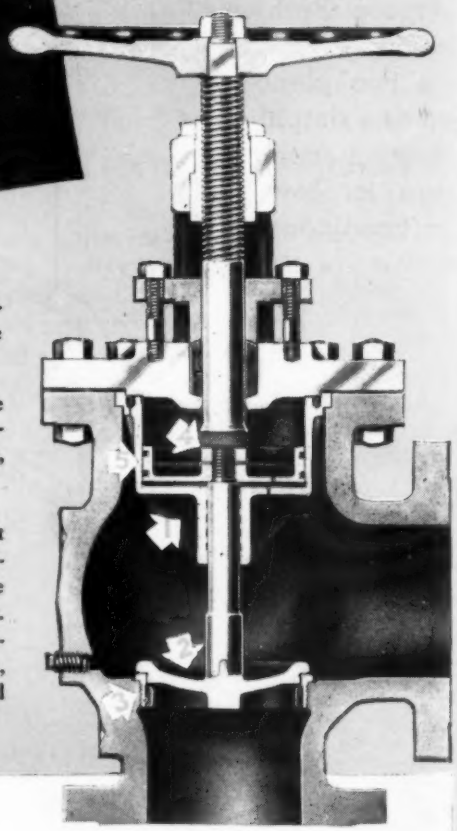
* The correlated use of FLEX-ANAL CHARTS and HANGER BULLETIN 1863 saves time in engineering man power which can be devoted to other useful purposes. Copies of these books can be obtained through a request on your business letterhead.

BLAW-KNOX COMPANY
POWER PIPING DIVISION
1525 PENNSYLVANIA AVE., PITTSBURGH, PA.

Prevent Valve Failure

NEGLECT RUINS A VALVE VITAL TO SAFETY...

Creates dangerous threat to life and property



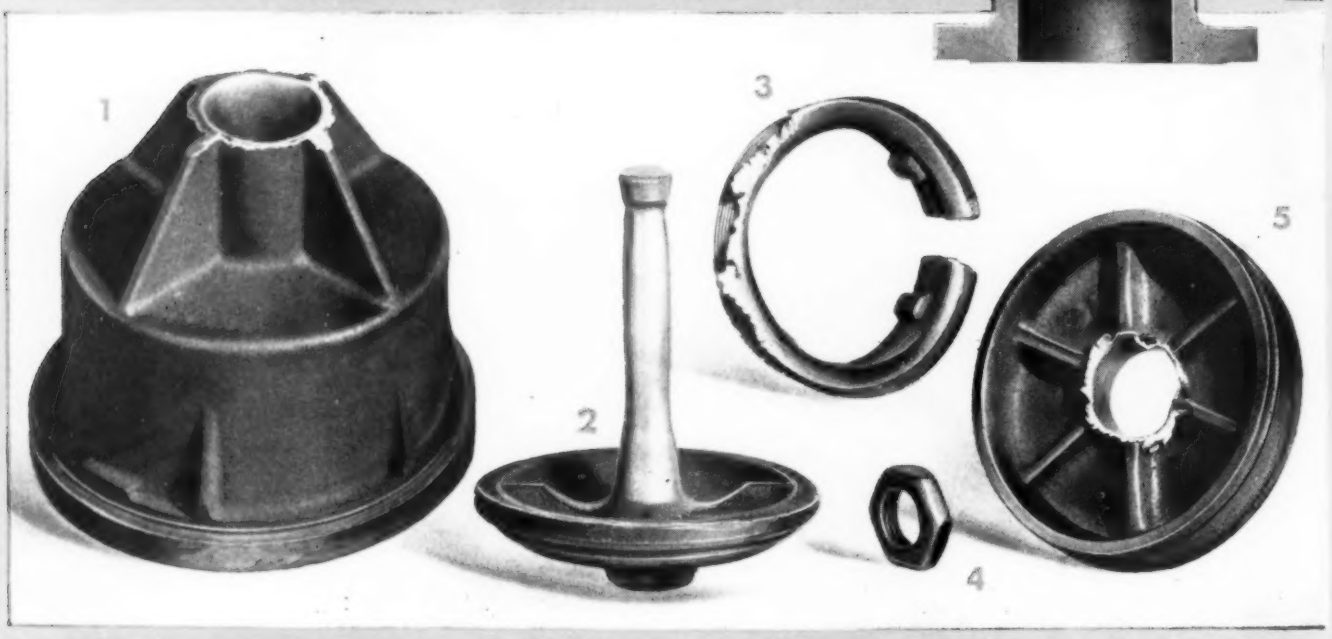
1 **DASH POT**—The piston rod guide, or bearing, at the base of the dash pot (cylinder) has been greatly enlarged by abrasive wear and vibration, losing all compression under the piston. With the consequent unchecked agitation of the parts in the steam-flow, destruction progressed rapidly.

2 **DISC**—It was ruined beyond repair by constant hammering when compression failed. The piston rod, integral with the disc, is worn to less than half its original diameter.

3 **SEAT RING**—Seating surface was battered to complete destruction. The shoulder of the seat ring was hammered to a paper-thin edge by the continual pounding of the disc on the seat face.

4 **PISTON NUT**—This part became loose from vibration after loss of compression. Though provided with a lock washer, it unscrewed with the piston.

5 **PISTON**—Because abrasive sediment collected in the cylinder, and because lubrication was neglected, the piston rings were badly worn and "seized" in the grooves. Compression became progressively less efficient,—was eventually lost completely, allowing the various parts to be battered by the pulsations of the steam flow.



JENKINS VALVES

before it starts!

To End Hazards and Prevent Production Slowdowns-

Give your non-return "Stop" Valves constant care . . .

No other valve in power plant service is more important for safe operation than the automatic Non-Return Valve for steam boilers. The A.S.M.E. Code, and the regulations of most states call for two "stop" valves between the boiler and the header, one of these being a Non-return valve.

When operating properly, the piston of the Non-return valve "floats" and "suspends" the disc in proper relation to the steam flow, and effectively cushions the moving parts. When the boiler pressure drops below that of the rest of the system, or an emergency occurs – such as the rupture of a boiler tube – the Non-return valve should be ready to close instantly and positively. The automatic functioning of the valve safeguards workmen who may enter a boiler to clean or repair it.

Make This A Standard Practise . . .

The simplified design and rugged construction of a Jenkins Non-return Valve assures faultless operation over a long period, *providing strict rules of maintenance are observed.* The piston and cylinder must be kept clean and properly lubricated, to maintain compression. If not, the destruction of other working parts will progress rapidly. The ruined parts illustrated had been in service more than three years without attention.

Inspection should be made, and the valve cleaned and lubricated, at least once a year. When conditions are unfavorable, this attention should be given at least every six months.

To Avoid Needless Interruptions and Save Vital War Material . . .

Make sure your valves are inspected regularly, systematically. Replace worn parts. Instruct maintenance workers thoroughly. Select valves for new installations carefully; install them properly.

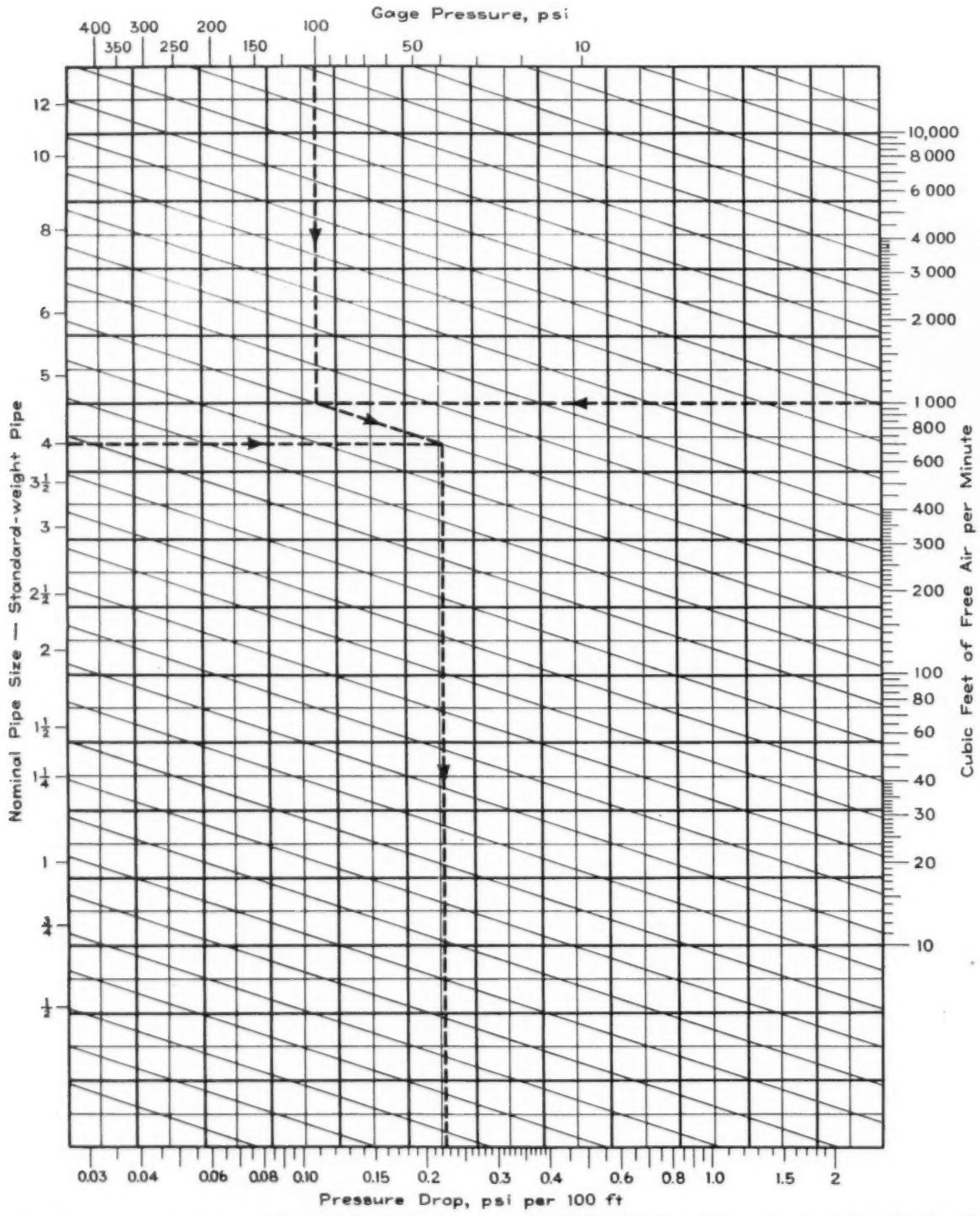
Jenkins Engineers will provide any assistance you need for improving your system of valve conservation.

Jenkins Bros., 80 White Street, New York, 13, N. Y.; Bridgeport; Atlanta; Boston; Philadelphia; Chicago. Jenkins Bros., Ltd., Montreal; London.

For every industrial, engineering, marine and power plant service

BRONZE ★ IRON ★ STEEL

Pressure Drop in Compressed-Air Pipe



► CHART GIVES PRESSURE DROP in compressed-air piping in pounds per square inch per 100 ft of pipe. Initial pressure, flow and size of pipe must be known or assumed. For example, 1000 cubic feet of free air per minute flowing through a 4-in. standard weight pipe under an initial pressure of 100 psi gage will lose 0.225 psi every 100 ft length of run.

Courtesy of Walworth Co

© POWER

PROBLEMS THAT COME TO GILMER...

Can you harness 50 H.P. with a light belt at 9000 F.P.M.?

An important commercial alcohol company had a centrifuge which was belt driven by a 50 H.P. motor. Belt speeds reached 9000 F.P.M., and no known belt lasted more than a few hours. The customer was ready to believe that belts couldn't handle the job.

Gilmer's men took a look at the job and installed an 8" Hevaloid* Belt, 126" long. Today, Gilmer Hevaloids are lasting for months... where all other belts failed in hours.

The same ingenuity which is solving belt problems all over the country, also has planned an important FREE war-time service to Industry. It's the Gilmer National Power-Recovery Plan, approved by WPB to save power in the following services: Steam, Gas, Water, Electricity, Mechanical Transmission, Boilers, Compressed Air, Refrigeration and Prime Movers. Write for your FREE copy today, and also ask for Gilmer's Handy Belt Selector... a mine of information on modern beltings.

L. H. GILMER CO., Tacony, Phila. 35, Pa.

***A WORD ABOUT GILMER'S HEVALOID BELTS:**

Hevaloid Belts are made by a patented process, exclusive with Gilmer in the United States. It is a neoprene impregnated endless cotton belting, in which latex penetrates every fibre of the cotton and stays there for the life of the belt. Lightweight Hevaloid Belts are smooth and vibrationless at high speeds, resist heat, oil, stretch and slippage... yet have shock-absorbing qualities for low-speed operation. This is an exclusive Gilmer Product.

USE WHAT YOU LOSE

Gilmer BELTS

The Oldest Firm of Rubber Fabric Belt Specialists

V-Belts (F.H.P. & Multiple); Flat Belts; Round Endless Belts; High Speed Belts; Fabric Belts; Planer Belts; Special Endless Belts

IT WILL DO A BETTER JOB ON THE SCRAP PILE THAN ON YOUR HEATING SYSTEM!

This country needs scrap metal . . . for war purposes, *but not in heating systems!* Here, nothing but the most efficient heating units can do the job of keeping industry in production and fuel consumption at a minimum. Junk equipment must be consigned to the junk pile!

Examine your heating plant—*now*—with the idea of settling two important questions. First, is it cooperating with the very real need for fuel conservation? Second, is it helping your profit picture by keeping operating expense at rock bottom? If not, *remember that steam-wasting equipment will do a better job on the scrap heap than on your heating system!*

Hoffman Steam Specialties will make your modernizing program a genuine success. Not only are they recognized by critical steam plant operators as highly efficient units, but they have features which substantially prolong service life.

For example, the Seats of Hoffman Traps are renewable. Should long service cause wear, simply remove the Seat and screw in a new one. The Thermostat, too, can be replaced without adjustment. In the Hoffman 50 Series Trap, a heavy duty unit, the Float, Valve Pins and Seats are *reversible*—giving double life at no extra expense.

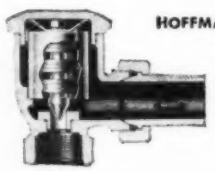
And now, while you are thinking about it, send for the new Hoffman Steam Specialties Engineering Bulletin. Remember that Hoffman field engineers are always available for consultation on your heating problems.

HOFFMAN SPECIALTY COMPANY
1001 York St., Dept. P-8, Indianapolis 7, Ind.

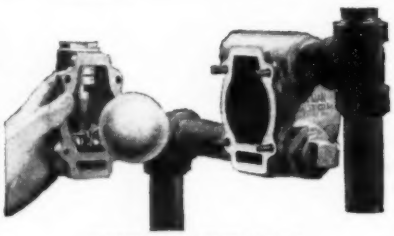
CHECK THESE POINTS FOR "SCRAP PILE" TRAP SPECIMENS

√ Steam Radiators √ Unit Heaters
√ Pipe Coils √ Downfeed Risers
√ Condensing Radiators √ Blast Coils √ Ends of Steam Mains, etc.

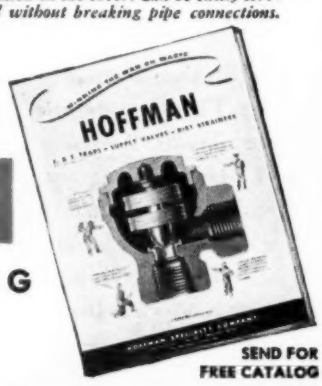
. . . AND REPLACE WITH DEPENDABLE HOFFMAN TRAPS



HOFFMAN No. 9H TRAP
A bronze-bodied unit for high pressure work. Renewable Seat and Thermostat.



HOFFMAN 50 SERIES TRAP
A heavy duty unit with all working parts mounted on the cover. Can be easily serviced without breaking pipe connections.



SEND FOR FREE CATALOG

HOFFMAN

CONTROLLED HEATING

STEAM HOT WATER

MAKERS OF VALVES, TRAPS, VACUUM AND CONDENSATION PUMPS, FORCED HOT WATER HEATING SYSTEMS

Amplidyne Control

(*Continued from page 66*)

produce rolls with smooth ends. A photoelectric device watches the position of the edge of the moving paper or steel. Any slight movement of the edge from its correct position causes a change in the reflected light to the photoelectric device. This change in light intensity is transmitted to the electronic amplifier which changes the excitation of the amplidyne-control field to position the ends of the roll with the edge of the sheet within 0.01 in. In this case, the amplidyne has two control-field windings. One, the reference-field winding, excited by 250-v current, and the other, the control-field winding, excited by the electronic amplifier.

Other applications of the amplidyne include: (1) control of synchronous-motor-field excitation to maintain the motor's power factor constant, irrespective of its load, (2) on hot-strip mills, control of the speed of the motor driving the reel core to keep constant tention in the strip, (3) accurately proportioning strip speed to melting power in flow-brightening of electrolytic tin plate, (4) positioning of the electrodes in arc furnaces to maintain correct power in the arc throughout the melting and refining processes, (5) accurately matching the speed of a flying shear in a steel mill to that of the mill to obtain exact length of steel, (6) control of speed of paper machines to permit making a greater number of paper grades on the same machine, (7) higher rates of acceleration and retardation of motors and their loads, and (8) control of load division between large dc motors operating in parallel.

It would require many more examples to cover the diversified applications of the amplidyne and even to suggest its many unexplored possibilities. It can be said, however, that this new tool has a place wherever an electrical or mechanical signal, no matter how small, can improve performance and increase production.

Valves and Heaters

(*Continued from page 71*)

ternal pilot creates an unbalance of forces acting on the main valve, causing it to follow the motion of the pilot. Thus, the force that moves the main valve is supplied by water pressure and not by the float mechanism. Since this

STOP THE NOISE

and damage of Valve-Slam...
install
CHAPMAN TILTING-DISC CHECK VALVES

Chapman's Tilting Disc is pivoted just above center . . . and the seat and disc rings are beveled . . . so the disc cushions itself to a drop-tight seat without any sliding or rubbing. This closing action positively prevents slamming . . . and the consequent vibration, hammering, surging, and opening of pipe joints either in horizontal or vertical lines.

Another exclusive feature of the Chapman Tilting Disc is its airfoil design which, like a plane-wing, has exceptional "lift", so there is minimum flow resistance when the disc is in the open position. This, plus the fact that net area through the valve is equal to net area of the pipe, *means 65% to 80% reduction in head loss* over conventional type checks . . . which often makes possible the use of smaller valves and discharge lines. Complete operating data is given in Chapman Bulletin No. 30. Write for a copy today.

The CHAPMAN VALVE MFG. CO., Indian Orchard, Mass.

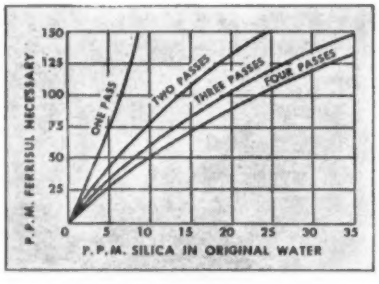
CHAPMAN

NON-SLAM CUSHIONED CLOSING

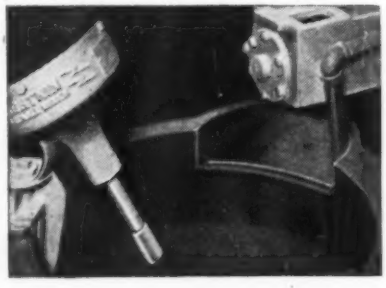
CHECK VALVES

SAVE FERRISUL

Without Sacrificing Efficiency In Treating Boiler Feed Water



1. Consider the application of multi-stage or counter-current use of ferric hydrate floc formed by Ferrisul. The savings possible are obvious from the curves on the accompanying chart. These curves show parts per million of Ferrisul needed to reduce a given silica content to one P. P. M., with 1, 2, 3 or 4 passes of the feed water through the Ferrisul floc.



2. Check feeding equipment to be sure Ferrisul is being dissolved completely. When shutting down dry feed equipment, stop the dry feeder and water feeder at the same time and continue agitation for at least a half hour to be sure no undissolved Ferrisul is left in the pot. When restarting, start the agitator, then begin feeding Ferrisul and water simultaneously.

FERRISUL, Monsanto's anhydrous ferric sulfate, is in heavy demand these days as a pickling agent for vital war metals. The metal industry prefers Ferrisul over similar chemicals for many of the same reasons that have made it a favorite in your field: (1) Its higher iron content means greater economy; (2) It has greater uniformity, (3) It is easier to store and handle. Since the output of Ferrisul is limited, it becomes necessary to make the most efficient use of every pound of this busy chemical—in every field it serves.

That is why we are suggesting ways for power engineers to make the supply of Ferrisul go farther in treating boiler feed water to eliminate silica and other elements that reduce heat-transfer efficiency without leaving dangerous scale-forming or corrosive residuals. We are trying to point the way to greater economy, without sacrifice of extra steam output and extra life of boiler tubes and turbine blades—results you've come to expect from the use of Ferrisul.

Monsanto's competent technical staff will be glad to study your plant and make specific suggestions on your efficient and economical use of Ferrisul. This service costs you nothing and places you under no obligation. Please address your request to MONSANTO CHEMICAL COMPANY, Merrimac Division, Everett Station, Boston 49, Mass.

MONSANTO CHEMICALS
SERVING INDUSTRY...WHICH SERVES MANKIND

Help! Prompt return of empty tank cars, carboys and returnable drums will help speed your *next* shipment of Monsanto Chemicals . . . by helping to relieve critical shortages in shipping equipment.

is a single-seated valve, it closes tightly on its seat without leakage when in the closed position. The valve disk should be equipped with a V-ported skirt to provide a desirable gradual regulating characteristic.

When water-inlet regulating valves must be of large size to handle the required flow, when extreme pressure conditions are encountered, or when the valve must be mounted in the piping at some point where it could not be reached by a direct linkage from the float, use a pneumatic- or hydraulic-operated valve. Choice between the two lies in the availability of a constant and reliable source of clean, dry air or gas, or of pure non-scaling water or oil under constant pressure. In either case, for best regulation use a double-seated V-ported or parabolic-disk valve, unless the need for a tight-closing valve makes a single-seated valve desirable.

Pneumatic Valves

Pneumatic valves, as in Fig. 3, are operated by a small pilot valve, mounted on the float mechanism, which delivers air or gas under a variable loading pressure to a spring-opposed diaphragm attached directly to the valve stem. The pilot valve, by varying air pressure on the diaphragm, controls the position of the main valve according to float position. The valve may be arranged either to open or close on failure of air or gas supply. Usually the former arrangement is preferred for inlet-water regulating valves. If the valve fails open, the heater merely overflows, but if it were to fail closed, a shutdown might result before water flow could be reestablished.

With a pneumatic valve, the air- or gas-loading pressure established by the pilot valves bears a direct relationship to the position of the float. If the valve were perfectly balanced and there were no friction in the stuffing box, you could assume that the valve's position would also bear the desired direct relationship to the float's position. This is not the case, however, for both unbalance and friction tend to displace the valve from the position that it should theoretically assume. In most cases, this slight displacement is not serious, but erratic operation may result when large valves are used, load changes are severe, or water pressure, either downstream or upstream of the valve varies widely.

Most pneumatic valves can be equipped to assure the valve taking a position with definite relationship to the position of the float regardless of such extraneous forces. This feature usually

Increase resistance to DEZINCIFICATION!

USE ARSENICAL ADMIRALTY

No "cure-all" tube alloy, but one to consider if you're troubled with dezincification

THE AMERICAN BRASS COMPANY has been manufacturing Arsenical Admiralty Condenser Tubes on a commercial basis since 1934.

This alloy was introduced as a result of extensive research work, begun several years earlier, which demonstrated that the addition of a very small percentage of arsenic to the standard Admiralty Alloy materially increased its resistance to dezincification.

The consistently satisfactory performance of Anaconda Arsenical Admiralty Condenser Tubes in almost every kind of service has substantiated the results of laboratory tests.

While Anaconda Arsenical Admiralty Condenser Tubes have been quite generally used, they are especially well-adapted to those installations in which the older alloys showed definite tendencies to dezincify.

Technical Service Available

It is a function of the engineers of our Technical Department to assist Condenser Tube users in the selection of the most economical tube alloy for any given set of operating conditions. Please feel free to call on us. Publication B-2, sixth edition, gives up-to-the-minute data on Anaconda Condenser Tube and Head Plate Alloys. A copy will be mailed to you for the asking.

4263

ANACONDA from mine to consumer

Anaconda Condenser Tubes

THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Conn.

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MOUNTED WITH COOLING UNIT

JUST LAY IT ON THE FLOOR

and hook up to current and air lines . . . . . .

In spite of the fact that the SCHRAMM Compressor unit shown above comprises motor, compressor and radiator, it actually is a "one-piece job". All are assembled rigidly and in perfect alignment on a substantial steel base which can serve as a vibrationless foundation. No belts, pulleys, flywheels or water connections are necessary.

Schramm Water-Cooled Air Compressors can be depended on for outstanding performance and satisfactory cooling under all temperature conditions, summer or winter, because water jackets completely surrounding cylinders and heads assure uniform cooling.

If it's a Schramm you can pack a 600 cu. ft. per min. job into a space measuring only 90 ins. x 37 ins. Schramm's vertical, in-line design makes it a neat, compact package, for heavy and continuous service . . . Motor controls for the required starting current and torque can be furnished as a part of the unit or for remote installation . . . Sizes range from 50 to 600 cu. ft. displacement at 100 lbs. pressure.

THE DATA YOU'LL WANT before deciding on any compressor can be found in our Catalog 42-S. Your request will bring a copy by return mail. Write today.

SCHRAMM INC.

THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

consists of a secondary pilot device connected to the valve stem by mechanical linkage. Loading pressure, established by the main pilot connected to the float, is applied to this secondary pilot mechanism, which in turn applies a loading pressure to the main diaphragm, based on the primary loading pressure but modified by the valve's actual position. With this arrangement, any displacement of the valve from the true position acts through the positioning device to vary the loading pressure on the valve diaphragm in the exact amount necessary to restore the valve to its correct position.

Hydraulic valves may be of the diaphragm type, similar to the pneumatic valve just described. Another type, however, which avoids the use of springs and diaphragms by means of a hydraulic piston, as in Fig. 4, must be equipped with a repositioning linkage if used as a regulating valve.

Pilot Valve Operation

In operation, a slight change in float position acts through a linkage to displace the pilot valve from its neutral position. This, in turn, admits water or oil under pressure to one side of the piston and permits escape from the other side, thus causing the piston to move and change the position of the main valve. As the valve stem moves, the motion is carried through the repositioning linkage back in the proper direction to restore the pilot to its neutral position. The valve, therefore, always takes and holds a definite position in relation to the float.

Floats for operating regulating valves may be located either within the heater's storage compartment or in a separate float chamber connected thereto. The internal float arrangement takes up less space and is usually less expensive. The extra cost of an externally mounted float, however, is often well repaid by the fact that the float can be repaired or replaced without shutting down the heater, provided, of course, the float chamber is equipped with isolating valves. Also, if it is ever necessary to change the float level, the separate float housing can be relocated by a simple change in external piping but, with an internally mounted float, range of adjustment is definitely limited.

Size of float depends upon the maximum pressure differential across the valve and the amount of unbalance inherent in the valve. Always rely on the manufacturer's recommendation in selecting float size.

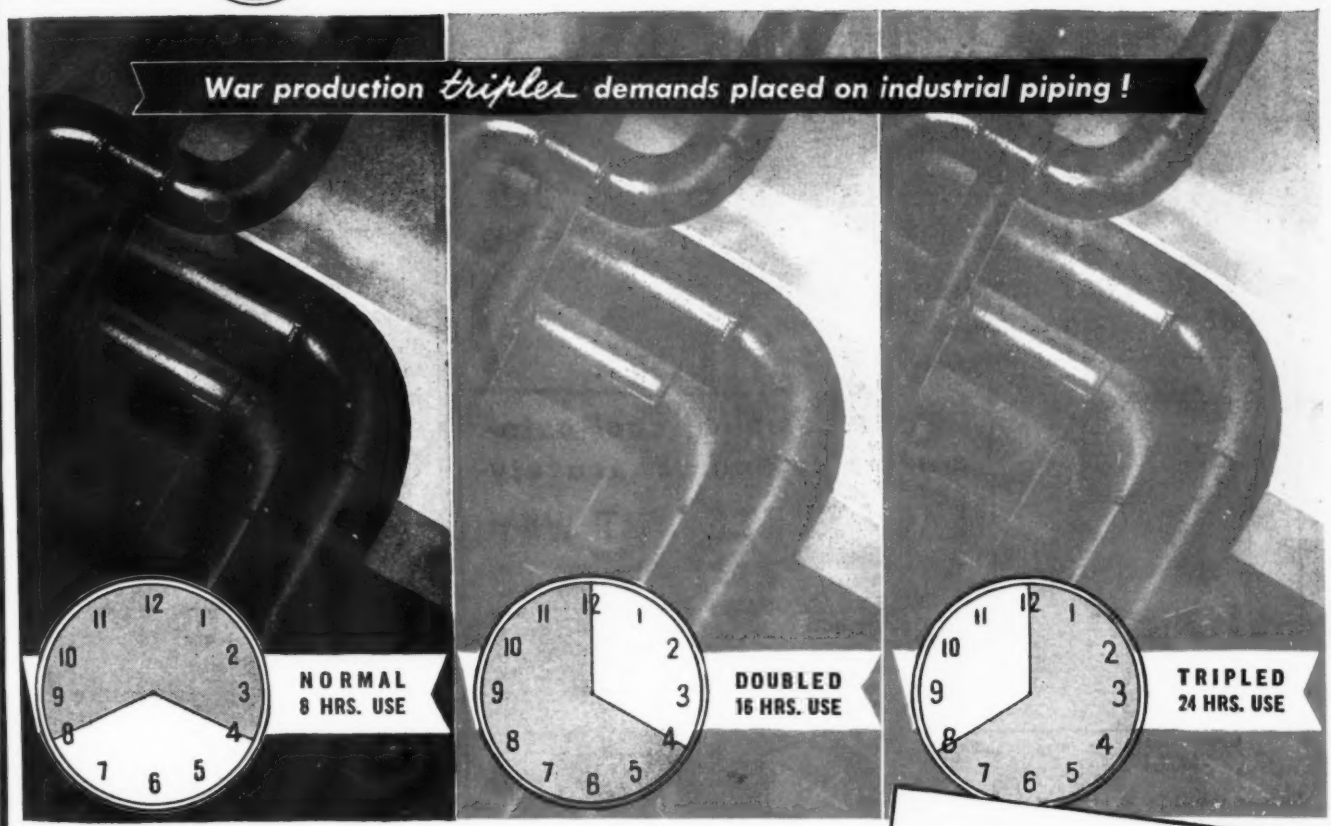
Valve adjustment and maintenance

NO. 7 OF A SERIES

HOW TUBE-TURN WELDING FITTINGS BENEFIT WAR INDUSTRY

The FIRST WELDING FITTINGS 1ST AND STILL THE BEST

Welding with TUBE-TURN fittings gives extra strength and trouble-free performance needed today to insure uninterrupted piping service



'ROUND the clock, war-time operation for 24 hours a day instead of the normal 8 hours period *triples* the wear of oil, gas, power, chemical, heating, air, refrigeration and marine piping today.

Despite the extra strain that fittings naturally take, coupled with constant three-shift operation, Tube-Turn welding fittings are *practical insurance* against piping failures. Tube-Turn fittings are *stronger and safer* because of their exclusive construction advantages. They provide leakproof, trouble-free joints that last as long as the pipe itself. They can be installed faster and easier. can be quickly insulated, instantly eliminate maintenance worries, and provide streamlined, space-saving layouts.

Sizes, types and weights are available for every industrial requirement. *Write for catalog and data book No. 111.*

OTHER IMPORTANT WAR-TIME ADVANTAGES:

SPEED INSTALLATION: Less time needed for aligning, thanks to true circularity and uniform walls. Only simple butt welds required, easy even for novice welders. Whole sections can be preassembled on the ground.

SAVES CRITICAL MATERIAL: Absence of many flanges, bolts, nuts and heavy cast steel construction saves many tons of metal in a single piping system.

LAST LONGER: Smooth inner walls—with no ridges, waves or scale—means less corrosion and longer life.

LESS PRESSURE LOSS: Because of full effective radius and exact O.D. and I.D. alignment with the pipe, the flow is more efficient and pressure loss is less.

FEWER SUPPORTS NEEDED: Since welded piping weighs less and stands vibration better than flanged systems, few hangers or supports are required.

Winner of Army-Navy, Maritime Commission, Victory Fleet and Treasury Dept. awards.

BUY MORE BONDS!

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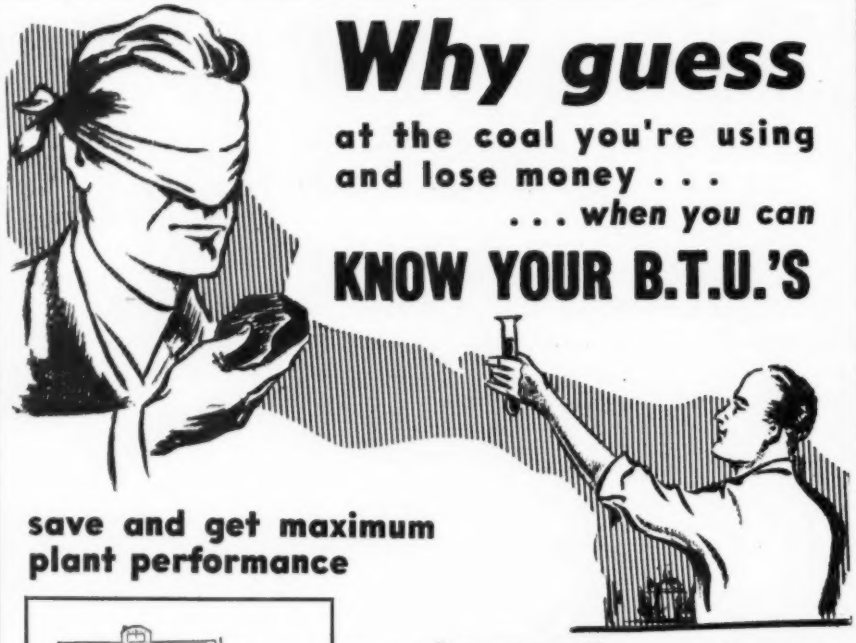
TRADE MARK

Welding Fittings and Flanges

TUBE TURNS (Inc.), Louisville, Ky. *Branch offices:* New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Dayton, Washington, D. C., Houston, Los Angeles. *Distributors in principal cities.*



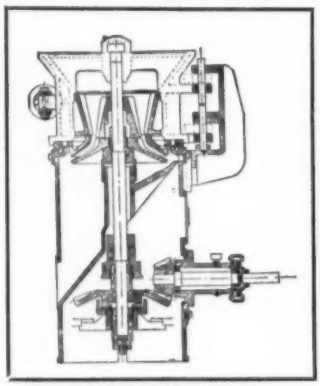
Why guess

at the coal you're using and lose money . . .

. . . when you can

KNOW YOUR B.T.U.'S

save and get maximum plant performance



Instant sampling is assured by the "STURTEVANT"

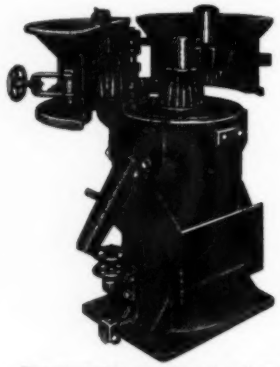
. . . by sampling coal automatically and accurately

THE STURTEVANT WAY

Hit-and-miss inaccurate results from hand sampling are "OUT" when you put the IMPROVED STURTEVANT AUTOMATIC COAL CRUSHER and SAMPLER to work. Not only is limited manpower (for hand sampling) replaced by machine power the "STURTEVANT WAY" but you are assured accurate representative samples that give you constant, true values of the coal you buy and burn.

Now is the time to eliminate guesswork—now when your sources of coal supply are such variable factors and when to "know your B.T.U.S." is so essential to the proper operation of your plant and its uninterrupted service. By eliminating guesswork as to your coal, the "STURTEVANT WAY" provides the means for adjusting your plant exactly to the coal as it is delivered to your bunkers. Now is the time to get the highest return from the dollars you spend for fuel, which today are probably your biggest single item of expense. Now is the time to provide your laboratory with coal samples that when analyzed will give you data from which maximum plant efficiency can be attained.

WITH THE "STURTEVANT", 3" coal samples are crushed to 8 mesh or finer at the rate of 1 ton per hour. Truly representative 5, 10 or 15% samples are taken ready for the laboratory.



Representative samples of coal are obtained by the "STURTEVANT" mechanically in a fraction of the time required for inaccurate hand sampling.

WRITE AT ONCE FOR

a copy of "HOW TO SAMPLE COAL AUTOMATICALLY." It contains important information on how to get the most out of your coal.

What users say

"The crusher gives us a more representative sample of a carload than we could hope for with hand sampling and with less expense."

"The difficulty of getting a laborer to conscientiously follow out the various steps eight or ten hours a day, every day of the week and the "human element" of inaccuracies are all eliminated."

Sturtevant Mill Co.

103 Clayton St., Dorchester, Boston, Mass.

are just as important as proper selection to direct-contact heater performance. No valve can regulate smoothly if improperly adjusted. Linkages between float and valve must be positive in action; they should transmit motion in either direction without binding or backlash. Linkage weight should be so counterbalanced that the entire force available from the float is applied directly to the valve. Valve and float should both move easily without binding.

Hydraulic or pneumatic valves require an unfailing source of clean and pure oil, water air or gas at constant pressure. To prevent bits of dirt, scale or foreign matter clogging the small ports or damaging the close clearances of the pilot mechanism, install a small filter ahead of the pilot valve. If pressure of the motive liquid or gas is likely to vary, place a small pressure-reducing valve in the line between filter and pilot valve to maintain constant pressure on the pilot.

Use All Float Travel

Most manufacturers take pride in the ability of their float-controlled valves to regulate water level within close limits. Such limits are frequently essential in process work, but in operating direct-contact heaters, particularly under fluctuating load conditions. avoid close limits meticulously. Adjust linkages between float and valve on direct-operated valves or between float and pilot on pneumatic or hydraulic valves so as to utilize maximum float travel. This greatly reduces momentary peak loads on the heater and on the low-pressure steam system serving the heater, as is apparent from the following example.

Assume that a heater is operating at about 75% load and that the regulating valve and float are adjusted to hold water level within a 1-in. range. If a sudden peak in boiler-feed demand momentarily doubles the outlet flow from the heater, the water level in the heater storage compartment tends to fall. In a few seconds, it reaches the lower limit of the range. The valve is then wide open, admitting the maximum quantity of inlet water and imposing a sudden heavy load on the heater. If the regulating valve were slightly oversized, this load might easily amount to several times rated capacity of the heater for the short time necessary to restore equilibrium between inlet and outlet flow.

On the other hand, if float and valve are adjusted to allow a range in water level of 10 in. instead of 1 in., the same

Dearborn Engineer believes in PREVENTIVE TREATMENT in your boiler room!

Preventive treatment gets to the root of boiler trouble. By anticipating the undesirable effects of the feed water supply, Dearborn Engineers can prevent damage to equipment and at the same time extend boiler operating periods so that maximum efficiency in boiler operation can be maintained.

Under ordinary operating conditions the necessity for repairs, due to improper water conditioning, is bad enough, but it is intolerable today when every ounce of steam that can be produced is needed in full time war service.

Replacement and Repair Parts are not readily available

Extensive tube replacements, for example, cannot usually be made on the spur of the moment. Priorities and allotments have to be considered. Dearborn Preventive Treatment therefore is of great importance.

Dearborn Engineer works right along with you in your boiler plant to forestall and prevent water troubles. He makes the necessary tests and takes on-the-spot steps to overcome any trouble which has started. If you are not using this service, call us. There is a Dearborn Engineer nearby to survey your plant, furnish correct treatment, supply expert engineering service, and make frequent and periodic checks to keep your boilers operating over long periods at top efficiency.

DEARBORN CHEMICAL COMPANY
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Chicago 4, Illinois

Dearborn
TRADE MARK REGISTERED

BOILER WATER TREATMENT AND SERVICE

[For Victory, Buy United States War Bonds and Stamps]

ALLPAX

THE PACKING THAT "PACKS ALL"

. . . use it once and

. . . you'll use it always

THE ALLPAX CO., INC.

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Distributors Everywhere

Here's the universal packing that can be used for any fluid or on any apparatus. One size packs all—economically, efficiently—tightly—simply.

Try ALLPAX and you, too, will be enthusiastic over its easy application and long wear. You don't have to remove old packing to repack with ALLPAX. Square cross section makes ALLPAX easy-filling in any stuffing box.

Try it and you'll always use it. Full details on request.

A reproduction from an actual unretouched color photograph which illustrates the appearance of the gauge glass from directly in front.

The "Thrifty" Gauge Glass

"That reminds me of the two Scotchmen . . ." Many a time we've heard those words, and Scotch thrift is the subject of countless jokes. Yet the dictionary says that thrift is "wisdom and care in the management of one's resources." Thrift, in other words, is just plain common sense. The real joke is on the people who *don't* demand their money's worth.

When it comes to gauge glasses, the thriftiest glass you can buy is the one that lasts longest. And the gauge glass that lasts longest is the one which best resists corrosion and has the greatest ability to withstand pressures, extreme temperature changes, and mechanical shocks—the one which avoids installation strains because of its machine drawn accuracy.

There—in a nutshell—is a description of PYREX brand Gauge Glasses. They're made of a special resistant glass, similar to that in which housewives bake, and store food in the refrigerator; similar to that used for laboratory glassware and piping in chemical plants because it resists all acids except hydrofluoric.

You don't have to be Scotch to be thrifty. And it's no trouble to use "wisdom and care" in buying the world's most economical gauge glasses. Simply tell your jobber to send PYREX Gauge Glasses—P-Y-R-E-X!

"PYREX" is a registered trade-mark and indicates manufacture by Corning Glass Works, Corning, N. Y.

CORNING Glass Works Corning, New York

Pyrex Gauge Glasses

change in water level causes only a slight change in inlet flow. If the heavy demand continues, the water level is further lowered, gradually opening the regulating valve the amount required to meet the increased load. If, however, the heavy demand is only a momentary peak, the water level is drawn down only a few inches and the inlet flow increased only a slight amount. In either case, the wider range of float travel is advantageous. In the case of sudden increase in base load, it permits the load on the heater to build up gradually. In case of a momentary peak, the extra demand is largely absorbed by utilization of a portion of the stored water with only a slight increase in actual heater load.

Adjusting the float travel is usually a simple operation when a direct-operated valve is used. By changing the point of attachment of the operating rod to the float and valve levers, you obtain maximum float travel. An added advantage of maximum float travel is the increased leverage between float and valve thus provided. For pilot-operated valves, the adjustment method may be different, but it is usually equally simple.

Both in size and cost, the inlet-water regulating valve is a small item compared to the direct-contact heater which it serves. Its importance, however, cannot be over-emphasized for it can make or break an otherwise excellent heater installation. Serious consideration of the factors outlined should prove a help both in improving the performance of existing steam plants and in assuring trouble-free operation of new heaters.

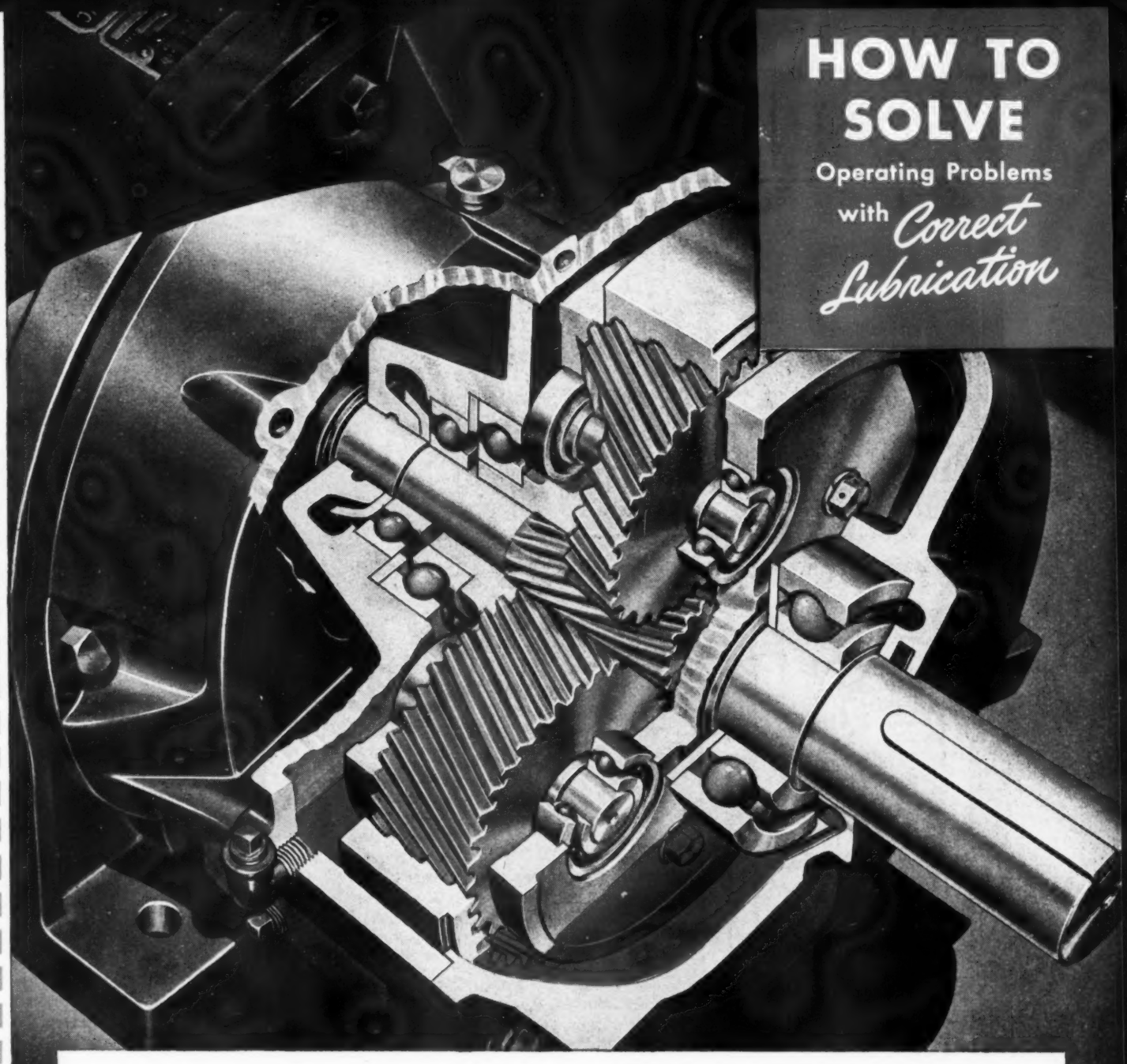
Colloidal Fuel

(*Continued from page* 73)

about 600 cu ft furnace volume. The burner enters the furnace at the rear under a horizontal baffle extending about halfway the length of the tubes resting on the first row. The gas crosses through tubes upward at front of boiler, then follows usual vertical baffling, crossing tubes twice more to reach damper outlet at top of rear tubes.

The boiler was first operated on oil to establish normal operating characteristics. It was then operated continuously on colloidal fuel. Ratings from about 40 to over 200% were carried without difficulty, but for a considerable part of the test the boiler was operated at about 100% rating.

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION



HOW TO SOLVE

Operating Problems with *Correct Lubrication*

Prepare them for 3 Shifts!

WHEN YOU CHANGED from one shift to three, you began crowding *3 years of wear* into one calendar year of operation!

You've got to *condition* your machines for full-time operation. You can't expect them to stand the gaff with "good enough" lubricants.

On such important production units as geared motors make sure you are using a Gargoyle Vacuoline Oil.

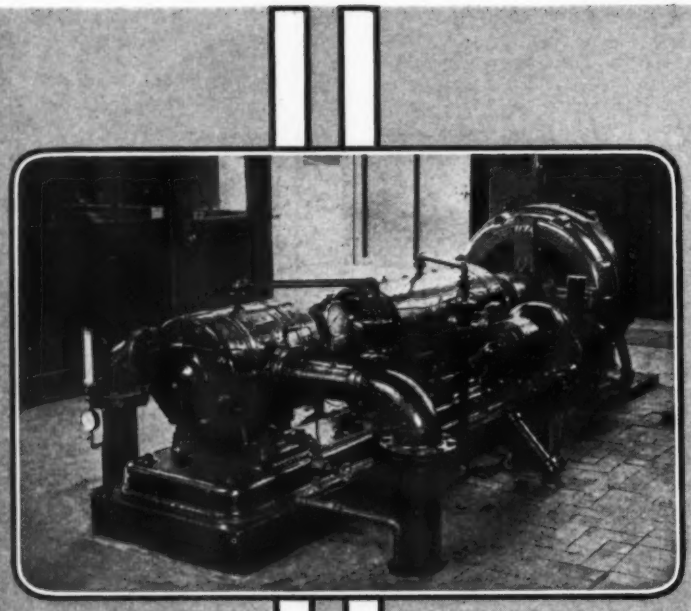
This member of the famous Gargoyle "family" has the chemical stability to stand up under "round-the-clock" operation. This means...freedom from emulsions and sludge...long oil life...and long, trouble-free gear life, too!

In fact, Gargoyle Vacuoline Oil is ideal for enclosed circulation-oiled and splash-oiled gears. Forty-eight hours a week—or 168 hours—this oil will provide dependable lubrication.

GARGOYLE Lubricants

SOCONY-VACUUM OIL COMPANY, INC. — Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Magnolia Petroleum Company • General Petroleum Corporation of California

CALL IN SOCONY-VACUUM



ROTARY COMPRESSORS

Fuller Rotaries are doing their part for victory in many war industry plants. Shown above is one of fourteen Fullers doing duty for an eastern steel company, running night and day with minimum time out for repairs.

They'll still be running long after victory has been attained and, at maintained original capacities . . . because they're built for just that kind of service. Simple design, rugged construction . . . only three moving parts: rotor—bearings—blades.

Bulletin C-5 illustrates and describes these machines. It's yours for the asking.

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CHICAGO — MARQUETTE BLDG.

SAN FRANCISCO — CHANCERY BLDG.

C-85

FULLER

PIONEERS OF HIGH-EFFICIENCY ROTARY COMPRESSORS

At this rating, suction at the oil pump dropped from about 1.5 psi for oil to 4-in. Hg vacuum for colloidal fuel. Pressure at the oil-control valve was maintained for both fuels at about 30 psi. At the burner, pressure for oil was practically zero; for colloidal fuel it was about 2 psi. Steam consumption increased about 70%. Load on the pump increased. Under one set of operating conditions this load was about doubled. When considering colloidal fuel in present plant equipment, pay close attention to the problems of increased suctions, pressures and loadings on pumps. Pump capacities may be lowered.

Colloidal fuel has considerable abrasiveness. It acts something like a lapping powder. It is doubtful, however, if this characteristic would necessarily be a serious handicap to successful operation. Watch equipment affected and repair as necessary. There was wear on the pump, shown in Fig. 3, most of it at the spindle. No repairing, however, was necessary during the run. There was also some cutting at the burner tip.

Does Coal Settle Out?

When considering colloidal fuel, the question always arises as to the possible settling out of the coal from the mixture. This depends on many factors, such as fineness of grinding coal, type of oil, temperatures involved, and agitation or movement given the fuel. Undoubtedly, the finer the coal is ground, the better it remains in suspension. From a practical viewpoint, however, it is desirable not to grind the coal any finer than necessary. Most settling is apt to occur in the heater. At this point, parts of the fuel are heated much higher than average temperature of fuel leaving heater; the higher the temperature, the more settling is to be expected. In general, it is best not to have fuel any hotter than necessary at any point in the system up to the furnace.

Operating routine can be arranged to clean the heater when necessary. If there are two heaters, they can be used alternately. At the Atlantic plant tests, it was unnecessary to clean the heater on any of the runs that lasted about seven days each. There was appreciable accumulation, however, in the heater when the 88 and 95% coal through 230 mesh was used; there was practically none with the 99% coal. Some settling occurred in the tank with the 88% coal, but none with the 95 and 99% so long as the storage tank was kept around 85 F. No settling or clogging

Wide Range of Low Driving Speeds

in a Single, Compact Variable Speed Unit . . .

The New REEVES *Reducer-Type* TRANSMISSION

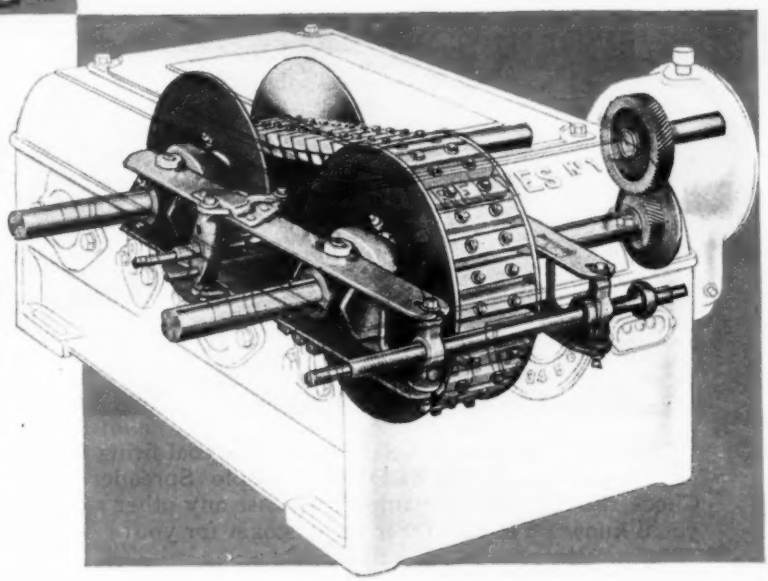
The REEVES Variable Speed Transmission —industry's widely preferred unit for providing accurate, instant speed adjustability—is now available with built-in, helical-type speed reducer.

With this new REEVES drive, speed adjustability and reduction are secured, without the use of other auxiliary speed reducing equipment, and the operator of any production machine has a wide range of low driving speeds instantly available in a single compact unit.

The REEVES Reducer-Type Transmission is offered in two completely enclosed designs—horizontal and vertical—each available in many different horse power capacities and ranges of speed variation. Both designs are highly adaptable and may be mounted in most any position to meet individual installation requirements.

It is easy to equip either design for individual motor drive by use of the REEVES adjustable motor base, as pictured above, which accommodates any available motor. Send for full details. Use handy coupon below.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA



"X-ray" view showing how reduction gears are mounted on the variable speed shaft of the Transmission, this shaft serving as the input shaft for the reducer unit.

REEVES *Accurate-Variable* SPEED CONTROL

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Send copy of 16-page Catalog PTR-432 giving complete engineering information on the new REEVES Reducer-Type Transmission.

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BURNS *ANY COAL* EFFICIENTLY . . . BURNS *WET OR DRY* COAL EQUALLY WELL . . . BURNS COAL LIKE OIL—FINES ENVELOPED IN AIR BURN IN SUSPENSION—LARGER PIECES ARE SPREAD EVENLY OVER GRATES . . . IS SIMPLE AND EASY TO MAINTAIN . . . REQUIRES NO SPECIAL SKILL OR EXPERIENCE TO OPERATE . . . IS INSTALLED EASILY IN MINIMUM TIME . . . RESPONDS INSTANTLY TO SUDDEN VARIATIONS IN LOAD . . . NO BANKING LOSSES . . . INCREASES BOILER CAPACITY . . . THIN FUEL BED ELIMINATES CLINKER FORMATIONS.

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AMERICAN COAL BURNER COMPANY
ENGINEERS • ESTABLISHED 1918
Builders of thousands of Industrial Stokers

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was experienced in the lines although they were relatively long. There was some clogging in meters and screens. Occasionally, throughout the day, the oil-control valve tended to clog but it could be readily cleared by opening it wide quickly. None of these difficulties was of moment. No boiler shutdowns occurred from operating troubles.

No difficulties arose in burning fuel in the furnace with the steam-atomizing burner. The flame responded smoothly to changes of boiler load and to variations in the quantity of air used for combustion. It could be controlled as easily as with fuel oil. The CO_2 content of combustion products could be carried as chosen up to about 16% with no CO. Burning colloidal fuel after it is in the furnace does not present much of a problem. Experiments are now under way on rotary-cup burners, which have shown good combustion.

Furnace troubles from coal ash were less than had been anticipated. Use of pulverized coal has supplied a vast amount of information on the action of ash in boiler furnaces and passes. It is not desirable to re-explore this field to any great extent in connection with an emergency fuel. If a plant operator wishes to estimate about how much trouble he might have from ash, what those troubles are, and how to meet them, he might visit a few pulverized-coal-burning plants similar to his plant that operate with similar coal at about the same loads. In general, he should expect much fewer ash troubles. Fig. 6 is a view of the furnace with the ash accumulation after about one week's operation. There was no dripping or slagging. Flyash on the tubes was cleaned without difficulty every eight hours during the test by the boiler soot blowers.

Boiler Efficiencies

About the same boiler efficiencies were obtained with both oil and colloidal fuel.

At present, there is no commercial source of colloidal fuel. Various concerns are considering its production. At least one oil user is now setting up his own grinding and mixing plant and other large users might consider such a measure. The Bureau of Mines and the Atlantic Refining Co are undertaking studies to arrive at a low-cost mixing device. Standard pulverizing equipment that grinds coal to the fineness of that used in the tests is now on the market.

The question of costs is rather involved. How much can be afforded for emergency fuel is an individual matter. Equipment cost for complete conver-

BELTING AND HOSE WITH A THUMB

Man owes his handiness to his thumbs. It is the thumb that gives grip to the hand. It is the thumb that enables man to master and control physical activity.

The thumb represents the power and capability that sets man apart from other creatures—so we use it to symbolize the extra something that distinguishes Thermoid belting and hose and other industrial products.

The engineers and production experts who build Thermoid Industrial Products approach their work with a knowledge of end-use problems. Beyond their equations and specifications, these men see the millions of tons of material that will be carried on a conveyor belt . . . the miles of seams to be made with a length of welding hose.

The Thermoid name on industrial products is proof positive to everyone in your organization—from the President down—that the Purchasing Agent is giving Production and Maintenance the best that can be had.

P.S. In line with material conservation, Thermoid has prepared a series of bulletins on how to extend the life of rubber products now in use. You might find them helpful to be passed on as reminders to your operating people. Feel free to ask for copies.

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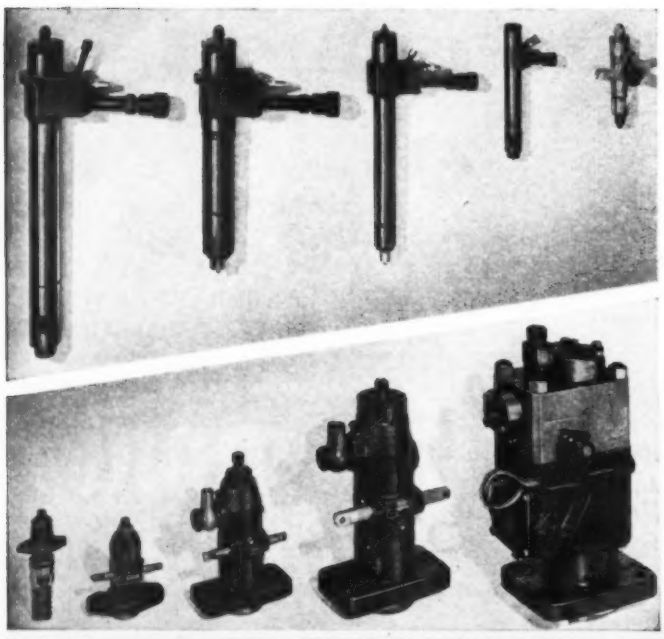

AIRCRAFT & DIESEL EQUIPMENT CORPORATION
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sion to coal may be very high. Under normal conditions in the past, colloidal fuel never proved an attractive proposition. Most oil-burning plants are in areas where under normal conditions it has been economical to burn oil. Colloidal fuel costs more when the handling, pulverizing and mixing of coal results in coal Btu cost higher than oil Btu cost. If needed equipment is obtainable, the Atlantic Refining Co estimates that on a production scale of 1,000,000 bbl per year, colloidal fuel could be sold in the Philadelphia area at about the same cost per million Btu as that of the 16-gravity fuel oil now being delivered.

Address inquiries regarding the tests to the Bureau of Mines, Washington, D. C.

Traveling Cranes

(*Continued from page* 81)

Letter the safe lifting capacity of each hoist in conspicuous figures on both sides of the load block.

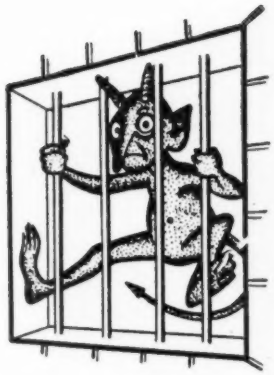
Gears and other revolving parts. Use sheet-metal or wire-mesh guards to inclose completely gears and other revolving parts, such as couplings and brake drums, which present a hazard. Overhung gears are dangerous unless provided with an effective means of keeping them in place, with keys secured in an approved manner to prevent gears from working loose. Do not leave unprotected keys projecting from shaft ends.

Operator's cab. Locate the cab so that the operator has a clear view of the work and can distinguish signals clearly. Fasten the cab securely in place with strong braces to minimize vibration. Allow ample room for control equipment as well as for the operator. He should not have to step over open space of more than 12 in. when entering or leaving the cab. Access ladder to cab from the bridge walkway should be at least 15 in. wide and have sufficient clearance for climbing. When needed, provide guards or baskets to prevent a fall from ladder to floor below. Bevel guard plates reduce head bumping hazards in ladder wells.

Fire prevention. Cranes subjected to heat from below should have a steel-plate shield ⅛ in. thick placed approximately 6 in. below the bottom of cab floor. Use fire-resisting construction for the cab. Locate a foot- or hand-operated gong, or other effective warning signal, convenient to the operator. Keep an approved fire extinguisher in the cab.

Outdoor service. Construct footwalk

Putting the acid-forming hydrocarbon in its place



(or how to avoid turbine oil acidity)

Hydrogen and carbon atoms in petroleum are united in more combinations than you can shake a stick at. Although most of these unions are contented, some are not. They're unstable. They crave oxygen. When they get it, they change from benevolent Dr. Jekylls to murderous Mr. Hydes. Then look out for your turbine! Look for deposits, sludge, acidity, poor demulsibility, etc. Some of these oxidized hydrocarbons tend to form asphaltenes, others to form acids. Particularly devilish are the kind that become acidic. These cause or contribute to about every kind of turbine oil trouble there is. They gripe oil men because they can't all be removed by any refining process yet discovered. Some of them remain in the oil, in spite of all that science has been able to do. Here is where Nonpareil Turbine Oil affords a great and unique advantage. It contains a patented inhibitor. Because of this inhibitor, all acid-forming hydrocarbons are locked up and rendered incapable of doing harm. As a result, we are able to give a written guarantee that Nonpareil's acidity (as expressed by neutralization number) will never exceed 0.15. In service, it is more likely to be around 0.05, as hundreds of turbines have proved after 5 to 16 years of operation. How we eliminate trouble from both asphaltenes and acids will be told next month. Meanwhile, if you want further information, send for a Standard Lubrication Engineer.

Write or phone the nearest Standard Oil Company (Indiana) office, or 910 South Michigan Avenue, Chicago, Illinois. In Nebraska, Standard Oil Company of Nebraska, at Omaha.

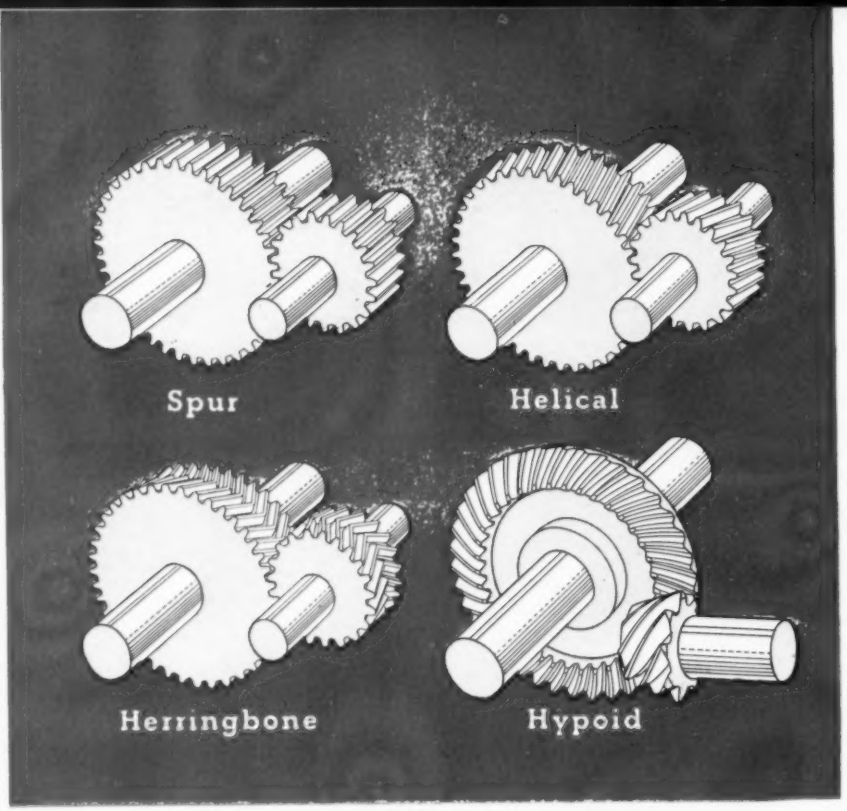
NONPAREIL TURBINE OIL

Oil Is Ammunition . . . Use It Wisely

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

★ LUBRICATION ENGINEERING

LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION



Help for hard-pressed teeth

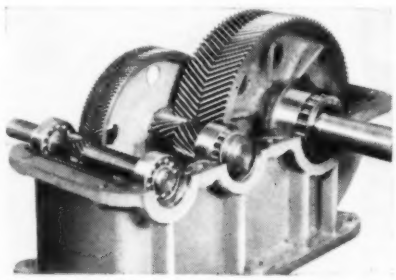
• FOR HIGH external temperatures combined with heavy tooth loads, high load peaks or shocks, and also for exposed locations with extreme variation of external temperature, a leading gear manufacturer specifies the use of extreme pressure lubricants. This recommendation is in line with much of our experience.

These lubricants provide a load-carrying capacity many times that of straight mineral oils. They prevent scoring and galling of teeth when pressures are too great for protection by ordinary oil film. In the top flight of this type of product are Stanogear Leaded Lubricants. These lubricants have an endurance far beyond that of the usual E. P. lubricant, and therefore require changing much less frequently. Here are typical examples of the results they give:

Stanogear more than match for trouble-maker. Excessive wear and scuffing were troubling a midwest battery plant using a set of large, broad herringbone gears to drive a zinc rolling mill. Pressures were high, there was considerable shock load, gears ran very hot.

A number of makes of lubricants were tried without correcting the trouble. Then a Standard Lubrication Engineer was called in. He recommended Stanogear Leaded Lubricant No. 6X because it lubricates the teeth in spite of high pressures and results in lower gear temperatures. Also, it is highly stable and does not form the excessive deposits sometimes associated with the use of such products.

To make doubly sure, the Engineer recommended spray application at the point of contact, resulting in further temperature reduction. These recommendations were adopted over a year ago, and the manufacturer has enjoyed trouble-free operation ever since.



Herringbone speed reducer. This type of unit may be subjected to high external temperatures, combined with high peak or shock loads. Prevention of excessive wear may require use of high quality extreme pressure lubricants, such as Stanogear Leaded Lubricants.

Again Stanogear to the rescue. Here's another case of trouble going out when Stanogear Leaded Lubricant came in: A central west metal working plant was having excessive wear on a three-speed transmission driving a cut-off saw, and involving a chain of gears in an enclosed case. The oil level at the lower end of the case was only about three inches deep and there was a vertical lift of approximately 16 inches to the top gear. Several gear replacements had been required during an eight-months' period, using a conventional S.A.E. No. 90 automotive gear lubricant.

When a Standard Lubrication Engineer was called in, he recommended Stanogear Leaded Lubricant No. 3X. Its excellent load-carrying characteristic provided positive lubrication, with the result that there has been no evidence of excessive wear in about 18 months.

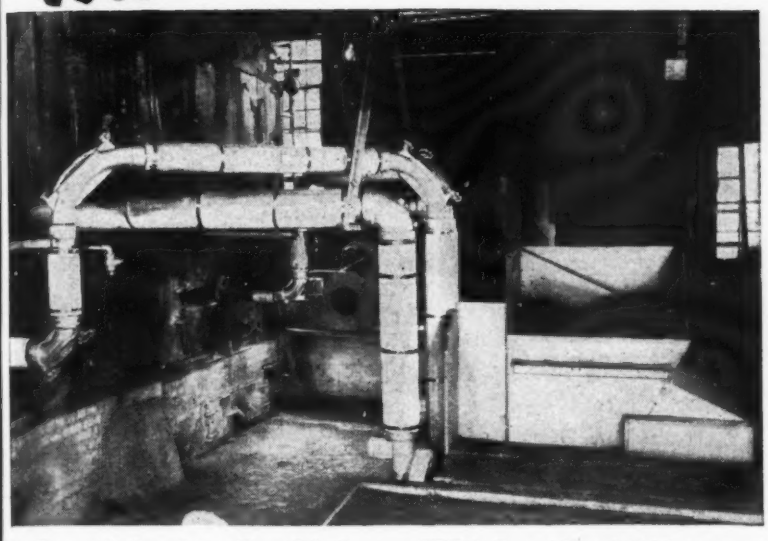
How to get help quickly. If you are having any trouble with power transmission equipment, let a Standard Engineer help you keep it doing its full wartime job. He has a complete line of lubricants which meet the many and varied requirements of this type of service. He also has had experience with ironing out difficulties with the same kind of equipment you use in your plant. For the Engineer nearest you, phone or write the nearest Standard Oil (Indiana) office, or 910 South Michigan Avenue, Chicago, Illinois. In Nebraska, address any Standard Oil Company of Nebraska office.

Oil is ammunition . . . Use it wisely

STANOGEAR
LEADED LUBRICANTS

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

IRON FIREMAN Uses a Ton Less Coal a Day - Handles 30% Load Increase



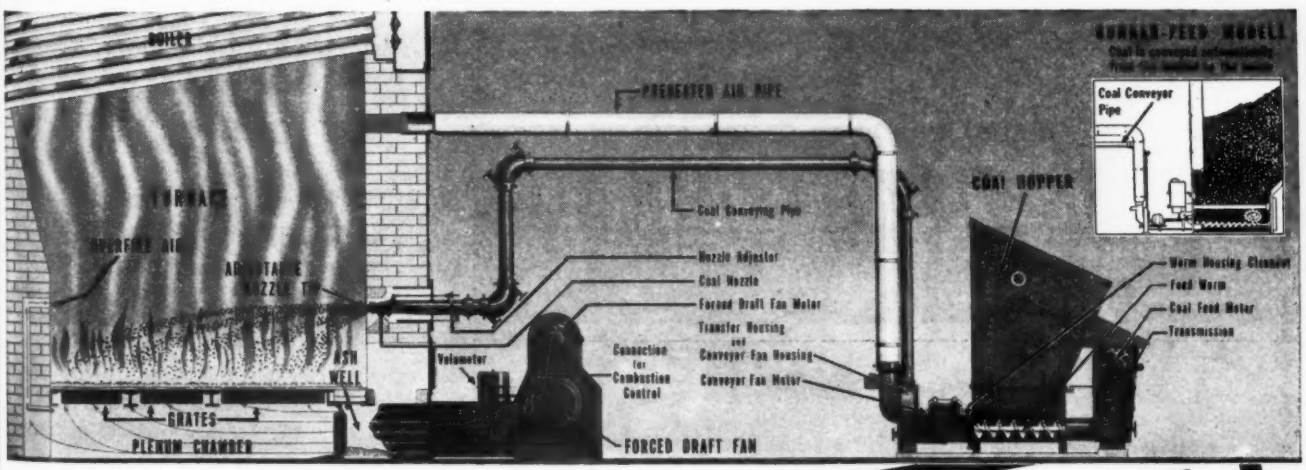
The Pneumatic Spreader at Giant Grip fires two HRT boilers—150 and 125 horsepower. Steam size coal is conveyed from the hopper to a transfer housing, where the coal is picked up by a stream of air and conveyed to the furnaces and grates. The fine burn in suspension, utilizing the conveying air for combustion. The larger pieces form a shallow fuel bed on the grate. By means of an adjustable nozzle, the coal is dropped by gravity and distributed uniformly over the entire grate surface. *At the back* is the under-grate forced draft fan unit. The auxiliary fan is mounted on the motor sheave for operation of the Volumeter, which adjusts the air supply according to the changing requirements of the fire bed.

★ IRON FIREMAN Pneumatic Spreader Achieves Remarkable Results at the Giant Grip Manufacturing Company

TO back the navy 100%, the Giant Grip Manufacturing Company of Oshkosh, Wis., had to increase its steam load 25 to 30% without installing new boilers. The boilers could not carry this increased load with hand-firing, so a year ago an Iron Fireman Pneumatic Spreader automatic coal stoker was installed. Before the Iron Fireman installation was made three of the five steam hammers could not be used because of insufficient steam, but now the Pneumatic Spreader stoker keeps three large and two small steam hammers in full and efficient operation. Also, Giant Grip uses one less ton of coal per day than it did with hand-firing, even with this increased load and increased working hours.

John Crall, *Engineer* at Giant Grip Mfg. Co. for over 30 years.

Output of Iron Fireman commercial and industrial stokers has been substantially increased to equip heating and power plants converting from oil, hand-fired coal and gas. Our nationwide organization of qualified factory representatives and dealers is at your service. Iron Fireman Mfg. Co., Portland, Ore.; Cleveland; Toronto.



IRON FIREMAN

Automatic Coal Stokers

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Contains full descriptions, capacities, operating data, etc., with layouts and photos of 10 typical Pneumatic Spreader installations. Sent free, on request. Write for literature. Iron Fireman Manufacturing Co., 3505 W. 106th Street, Cleveland 11, Ohio.

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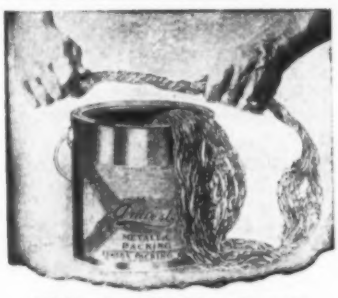

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"EUREKA"

EUREKA PACKING CO., 294-296 46th St., BROOKLYN, N. Y.

floors so that they drain properly. An enclosed cab of fire-resisting construction with windows on three sides is preferable; windows should be full-cab width in the front and the side opposite the door. Size and arrangement of openings must be such as to afford proper vision as well as to prevent a man falling out. Extend the floor of an outdoor cab to an exit landing that is equipped with handrail and toe guard of standard construction.

For repair work. Where there are no members over the crane suitable for attaching block and tackle for repair work, attach to the crane a structural steel outrigger of sufficient strength to lift the heaviest part of the trolley. Provide a latch or rail clamp when the crane is not in use to hold it securely in its normal position against wind pressure. Equip all gantry cranes with automatic warning signals that sound when the crane moves.

Gas Pressure Drop

(*Continued from page* 100)

Solution: To determine the friction factor, first compute Reynolds' number $N_R = \frac{Vd}{\mu g v}$. Reference tables or charts give a value of $\mu = 3.723 \times 10^{-7}$ lb – sec per sq ft. Then—

$$N_R = \frac{10\left(\frac{6}{12}\right)}{32.2\ (9.6)\ 3.723 \times 10^{-7}} = 4.23 \times 10^4$$

Fig. 1 gives a pipe friction factor of 0.022 for this Reynolds' number. Thus:

$$B = \frac{flv^2}{2gdp_1v} = \frac{0.022(10{,}000)(10)^2}{2(32.2)\left(\frac{6}{12}\right)(20)144(9.6)} = 0.247$$

If the fluid were a liquid, then $\frac{(p_1 - p_2)}{p_1}$ would equal 0.247. Entering the chart, Fig. 2, on the horizontal scale at 0.247, and proceeding to the curve gives the value of 0.289 on the vertical scale. Bear in mind that Fig. 2 is based on flow at constant temperature in a horizontal pipe. This latter value is the correct ratio of pressure drop to entrance pressure for air flow, that is:

$$\frac{p_1 - p_2}{p_1} = 0.289$$

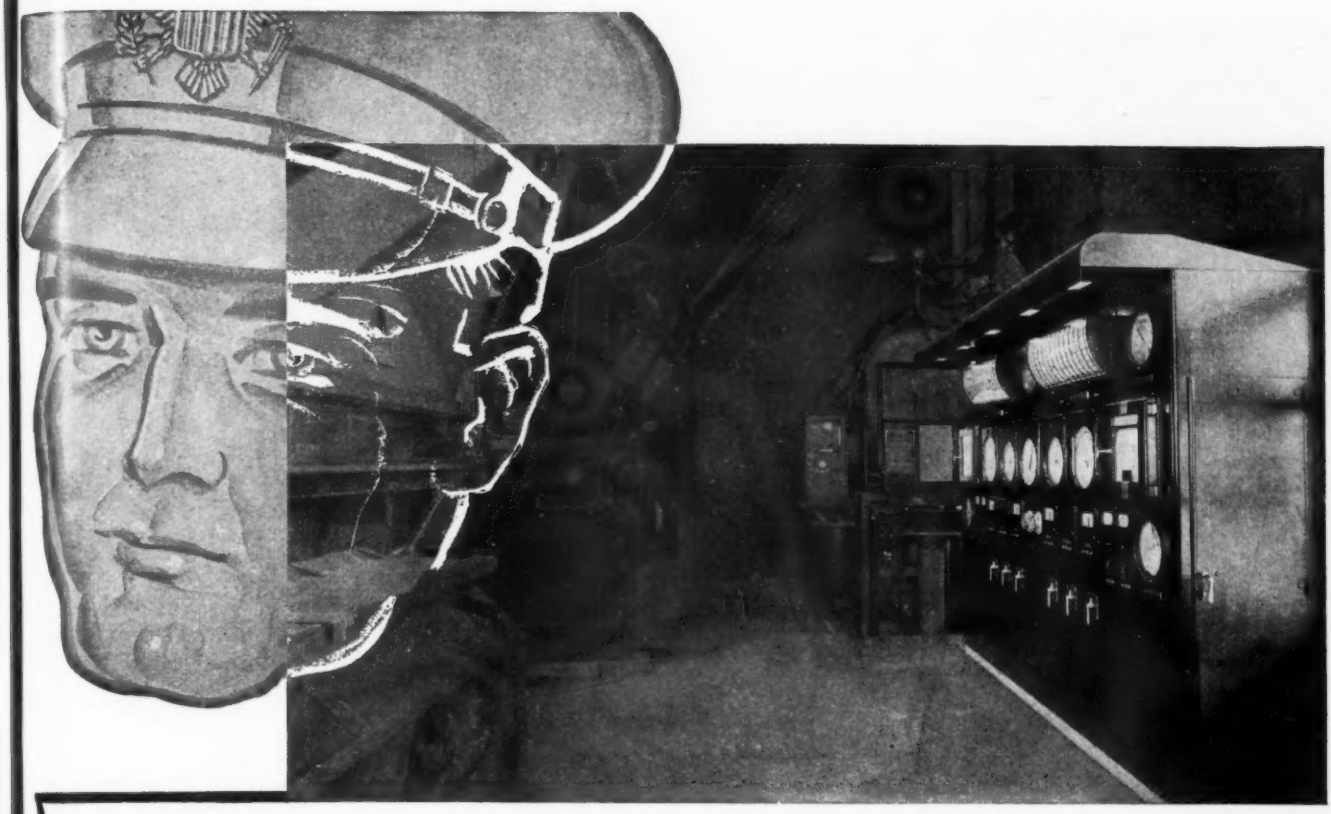
Therefore the final result is:

$$p_1 - p_2 = (0.289)\ (20) = 5.78 \text{ psi}$$

* Data for Fig. 1 from "The Flow of Fluids in Closed Conduits" by R J S Pigott, *Mechanical Engineering*, August, 1933, page 497.

** Derivation for this relation can be found in any one of a number of standard reference books, as "Principles of Thermodynamics," by G A Goodenough, Henry Holt & Co, 1927, page 156.

*** "Thermodynamics Fluid Flow and Heat Transmission" by H O Croft, McGraw-Hill Book Co, Inc, page 303.



LIKE A GOOD OFFICER, HAYS COMBUSTION CONTROL *Uses its head*

HERE'S a combustion control system that has no truck with guess work. It sticks to facts. It measures all variable elements, and regulates them. It corrects automatically, on the instant that need for correction is indicated. It even measures the corrections — sees that the right balance is maintained. In short, like any experienced, capable officer, it "uses its head," to get the most efficient performance possible from the equipment under its control.

Throughout the country, in many industrial power plants, Hays Combustion Control is on the job, using its head to the benefit of war production. It is making present equipment deliver more steam capacity, more efficiently. It is saving countless man-hours and dollars.

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Automatic COMBUSTION CONTROL

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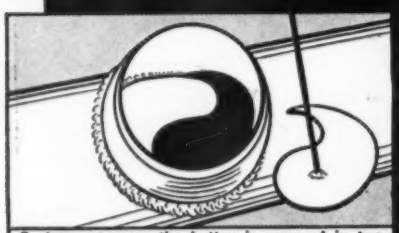
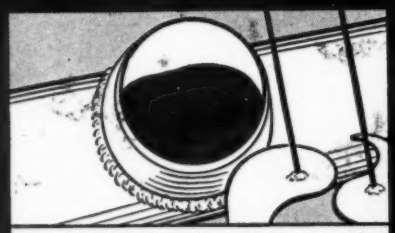
These 6 Steps Save Vital Man-Hours in Piping Installations

1—Install W-T's* anywhere on the main pipe without cutting, forming or fitting of the pipe. Simply select position of right-angle branch outlet and tack the fitting into place.

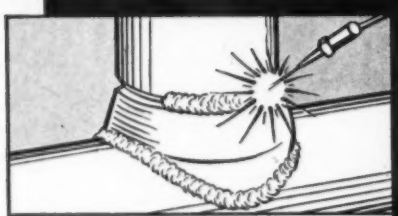
2—After tacking to insure the exact location of the W-T*, complete its installation by electric-arc or oxy-acetylene welding—following and filling the bevel at the base of the fitting.



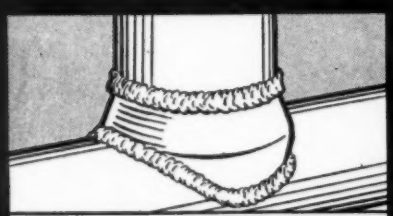
3—In most cases the button is removed in two sections with a torch after the WeldOlet or ThredOlet is installed—but where the outlet is smaller than 2", the hole should be cut in the main pipe first, using a drilling or hole saw.



4—This method of making a right-angle, welded branch pipe outlet insures a junction of full pipe strength—permits inspection of inside of junction—allows removal of slag and excess weld metal.



5—Branch pipe is attached by welding to outlet of fitting if WeldOlets or Socket-End WeldOlet has been used—or screwing into threaded outlet of fitting if a ThredOlet has been used.



6—A right-angle branch pipe outlet of full pipe strength has been made without the use of templets, without threading or fitting the main pipe and because of the patented design of the fittings—flow conditions have been improved.

3 Types Meet Every Need

Made of drop forged steel — to provide maximum strength. Available for all standard pipe sizes up to 24".

Branch pipe is attached to outlet of WeldOlet with plain, butt weld—to ThredOlet by screwing into threaded outlet of fitting—to Socket-End WeldOlet by weld around top of fitting after slipping branch pipe into outlet.

*WeldOlets-ThredOlets

Other Advantages

Lightweight compared to screwed or welding tees—saves metal—eliminates need for extra hangers and braces.

Elimination of exterior obstructions makes neater, more workmanlike installation, permits easier covering with insulation.

Adaptable to any and all types of piping systems—pre-fabricated or "on-the-job" assemblies—new construction or maintenance.

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THREDOLETS

Welded Outlets for Every Piping System

Readers' Problems

(*Continued from page* 113)

two-stage compressors, intercooler pressure above normal indicates that piston rings or valves of high-pressure cylinder are leaking. Subnormal intercooler pressure indicates leaky rings or valves in low-pressure cylinder.

Finally, before renewing the rings, JG could indicate his compressors after each 500 hours run and note the changes, if any, on the indicator diagram; also indicate them at full, three-quarter and half load.

New York, N. Y. P DONOHUE

Must Have Card From New Machine

INDICATOR CARDS have never been an accurate method of determining piston ring leakage in a compressor cylinder. To begin with, the only way to know how a perfect indicator card for the compressor would look, would be to take one when the unit is new and has been nicely run in. From then on, any future cards can be compared to the original; otherwise it is practically impossible for the owner to determine any variation from the true compression line of a unit.

Ring leakage would tend to show up in the form of a slightly jagged compression line. On present-day compressors running at relatively high speeds, it is doubtful if a card could be obtained that would really show the true condition of rings.

About the only satisfactory way to check rings and any possible leakage is to remove the piston enough to permit a check of the end gap of the rings in the cylinder. This gap should normally be .002 in. per inch diameter of the cylinder, that is, a 12 in. diameter ring should have .024-in. end gap when cold. If it exceeds this figure by much, the rings are worn and should be replaced.

New York, N. Y. C G KOHL

Keep Accurate Temperature Log

WE HAVE LONG SINCE STOPPED using indicator cards to find out if our compressor pistons are bypassing air from the compression to the intake side. If the intake pressure is higher than atmospheric (as shown by indicator

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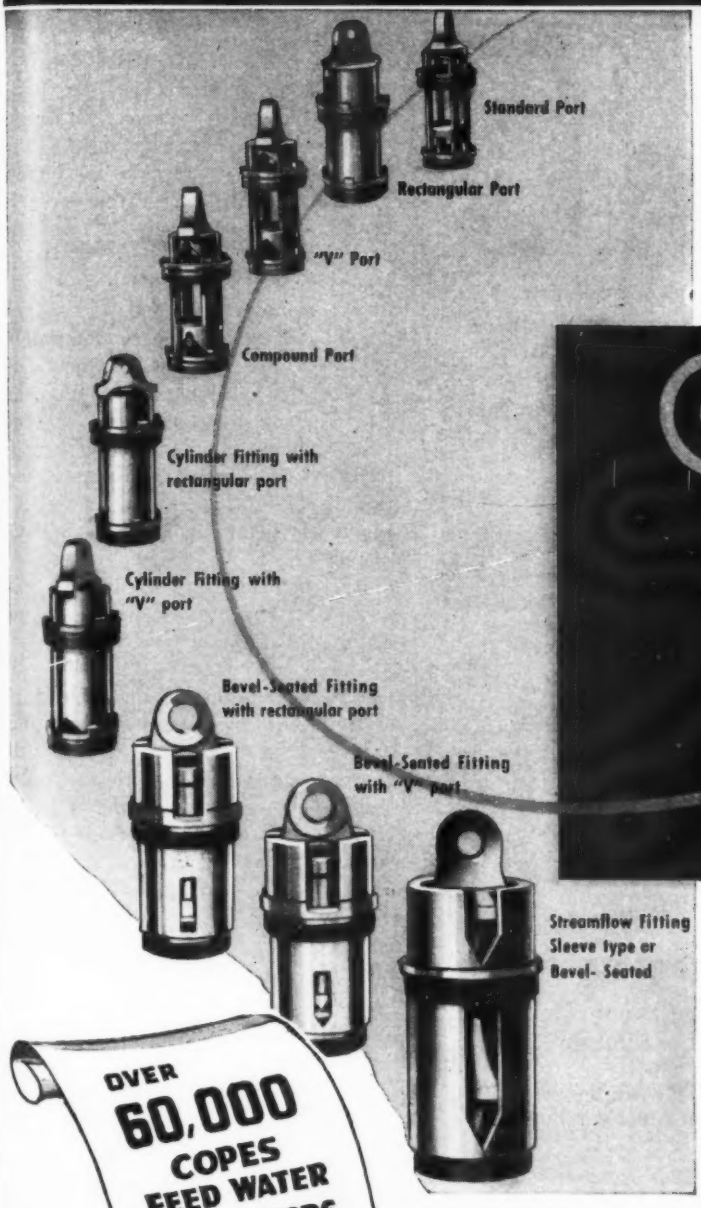
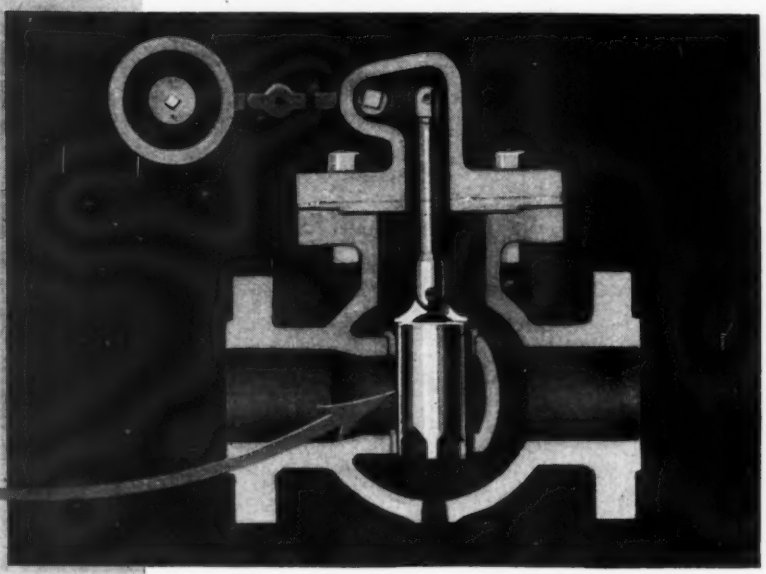
THAT'S WHY THE COPES BI-VALVE IS DESIGNED FOR THE BOILER IT SERVES



THE BI-Valve is as common to COPES Feed Water Regulation as is the familiar Thermostat. With 30 years of constant improvement and simplification, checked in over 60,000 applications, the BI-Valve is built to meet all boiler feed water requirements.

Out of several hundred exhaustive tests with as many different types of inner valves, we have learned which size of ports are necessary to give the proper imput to your boilers. They are tailored to meet specific operating conditions.



These "made to order" inner valves are one of the reasons for superior COPES performance—the closest relation between water imput and steam output—smoother charts.

Let COPES show you how to get the most out of your boilers.

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Feed Water Regulators • Pump Governors • Differential Valves • Liquid Level Controls
Reducing Valves and Desuperheaters

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And for fastest delivery—ship early, as soon as package is ready—as early in the day as possible.

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TODAY, AIR EXPRESS not only serves the home front but is also working hand in hand with the Army and Navy to supply our fighting fronts the world over.

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card) this is no proof that piston, cylinder, or piston rings, or a combination of these, are the cause. This pressure rise above atmospheric during the suction stroke may also be caused by leaking discharge valves. We believe in taking indicator cards on both steam and air cylinders of the steam-driven compressor, but only with the object in view of finding total horsepower required to operate the machine and the amount of work delivered by the air cylinders, in other words, checking up on the efficiency of such a machine.

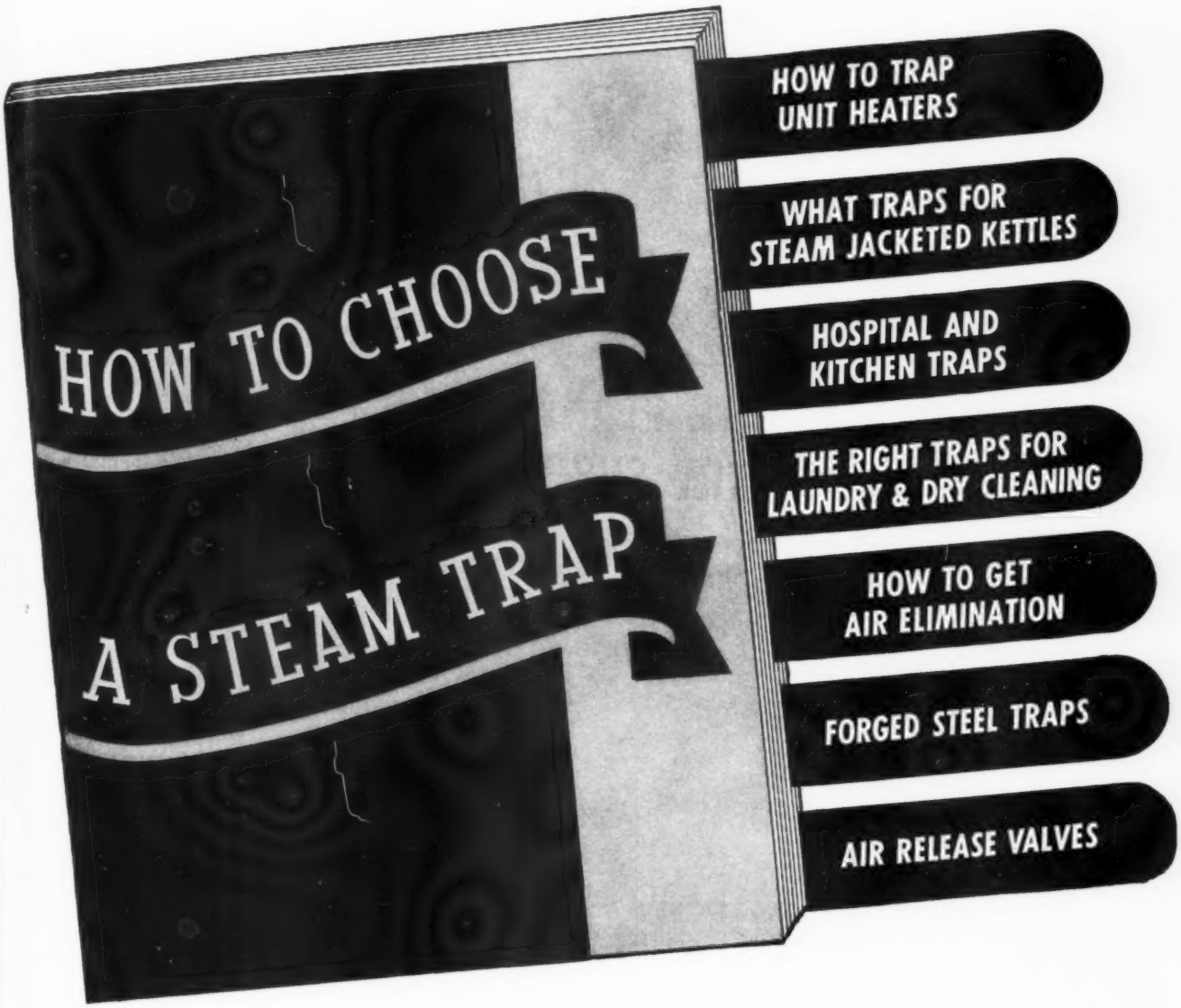
We consider it much easier to find the bypassing of air by scored cylinders and pistons or worn piston rings by opening indicator petcock connections on either end of the cylinder. Every time the piston compresses air there is a loud report through the indicator connection, now open to atmosphere. On the return stroke there is a report when compressing at the opposite end of the cylinder. Now if we also have air blowing out on the suction side of the piston we know air is being bypassed, and at which end of the cylinder. At this point it is still questionable what causes the bypassing so we examine the discharge valves; if they are absolutely tight, then we know that the air is being bypassed around the piston. Then, of course, nothing remains but opening the cylinder to find whether it is scored or whether piston rings are worn excessively.

The sketch, page 113, shows a card taken from the intake-air cylinder of a steam-driven compressor. From this card you can see that at the end of the compressing stroke, where the piston just begins to travel the other way, the intake pressure at the beginning of the stroke, and for a distance of about 20% of the stroke, is slightly lower than atmospheric pressure. This is true for both ends. The card therefore shows that this particular cylinder, so far as bypassing air is concerned, was in excellent condition and also that the discharge valves were tight.

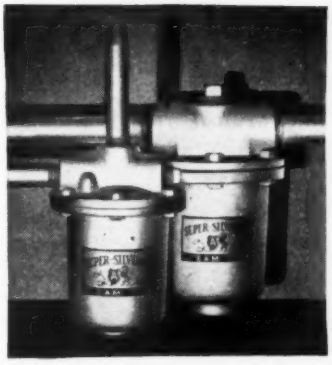
The day report from our 5400-cu-ft duplex compressor driven by a 1000-hp synchronous motor shows the low- and high-pressure cylinder air temperatures, also the jacket-water temperature. On the lower three lines is the intake and leaving temperature of the air at aftercooler and water temperature leaving aftercooler. These readings are another check, and a good one, on cylinder performance.

Let's take the low-pressure cylinder on the west side. The temperature of air leaving is 225 F, speed of compressor is 180 rmp, operating at full capacity. Should the next reading at

HERE'S WHERE
you can find the answer


HOW TO CHOOSE
A STEAM TRAP
HOW TO TRAP UNIT HEATERS
WHAT TRAPS FOR STEAM JACKETED KETTLES
HOSPITAL AND KITCHEN TRAPS
THE RIGHT TRAPS FOR LAUNDRY & DRY CLEANING
HOW TO GET AIR ELIMINATION
FORGED STEEL TRAPS
AIR RELEASE VALVES

When considering the installation of Steam Traps, any of 101 questions may pop into your mind. Questions on how to trap certain types of steam using units . . . how to get air elimination . . . what traps to use for high pressures and temperatures . . . or for the release of air. Regardless, you are sure to find the answer in this 44-page, 8½″ x 11″ book, entitled "HOW TO CHOOSE A STEAM TRAP." And in addition, this book gives you complete descriptions and information on Super-Silvertop Steam Traps that can be installed as an elbow or straight-in-line, making savings on installation time, work and fittings. Send for your free copy of this valuable book.



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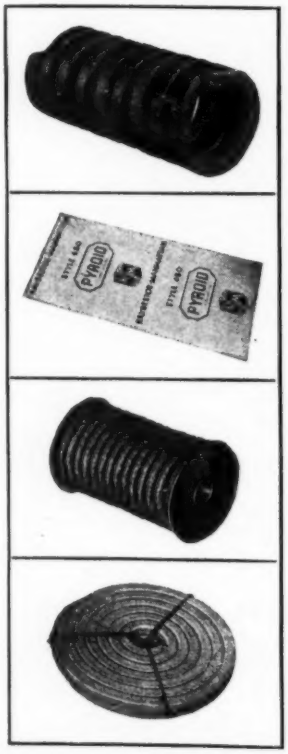
Consult your local R/M distributor on all packing jobs. He can furnish you with the right packing for every purpose. Ask him for a copy of the R/M catalog, too, or write us direct.

Awarded to R/M
North Charleston Plant



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RAYBESTOS-MANHATTAN, INC.
MANHEIM, PA.
BRIDGEPORT, CONN. NORTH CHARLESTON, S. C. PASSAIC, N. J.
Makers of Packings for Every Industrial Use

8:30 p.m. show a rise in temperature of say from 5 to 10 F with the circulating-water temperature still remaining 66 F, we would then know, and without an inspection of the machine, that we were by-passing air. This log is the first indicator of trouble. Temperature of air leaving low-pressure cylinder at the east side is 235 F and since cylinders are of identically the same diameter and operating at the same speed, this 10-F rise indicates some by-passing of air. We know this to be true because both piston and cylinder are slightly scored on the bottom, an accident which happened shortly after the machine was started about a year ago. However, we cannot spare this machine to rebore the cylinder and put in a slightly oversize piston.

This higher temperature of the east side shows 6 F higher than west side at the h-p cylinder intake. Water on the low-pressure cylinder of the east side is 2 F higher than that of the west side, and water leaving high-pressure cylinder is 4 F higher than that of the west side. The aftercooler inlet and outlet air temperature is 220 F and 86 F respectively. If the difference in these two temperatures becomes less we know that the aftercooler is not operating at its highest efficiency.

Temp ditch water, F		66
Outside temp, F		60
West Side	*L-p cyl*	*H-p cyl*
Temp air out, F	225	
Temp air in, F		82
Temp water out, F	96	
Temp water out, F		80
East Side		
Temp air out, F	235	
Temp air in, F		88
Temp water out, F	98	
Temp water out, F		84
Temp air intake aftercooler, F		220
Temp air leaving aftercooler, F		86
Temp water leaving aftercooler, F		104

Waterbury, Conn. A G GERMAN

Check Ring Side Wear

IN MY OPINION JG would do better to make a visual inspection of the piston rings and measure them for wear. The surface wear of the ring is not so important as the radial wear on the side of the rings and the up and down fit in the piston groove.

The ring should fit in the groove at all points around the circumference of the piston with no more than .002 in. clearance when measured with a feeler gage. If more than .003 in. clearance is present, the rings should be replaced, that is, if the wear is on the side of the ring and the lands of the groove.

There are so many conditions that affect an indicator diagram that it can

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WITH PERMUTIT* PROTECTING OUR BOILERS AGAINST SCALE AND CORROSION!

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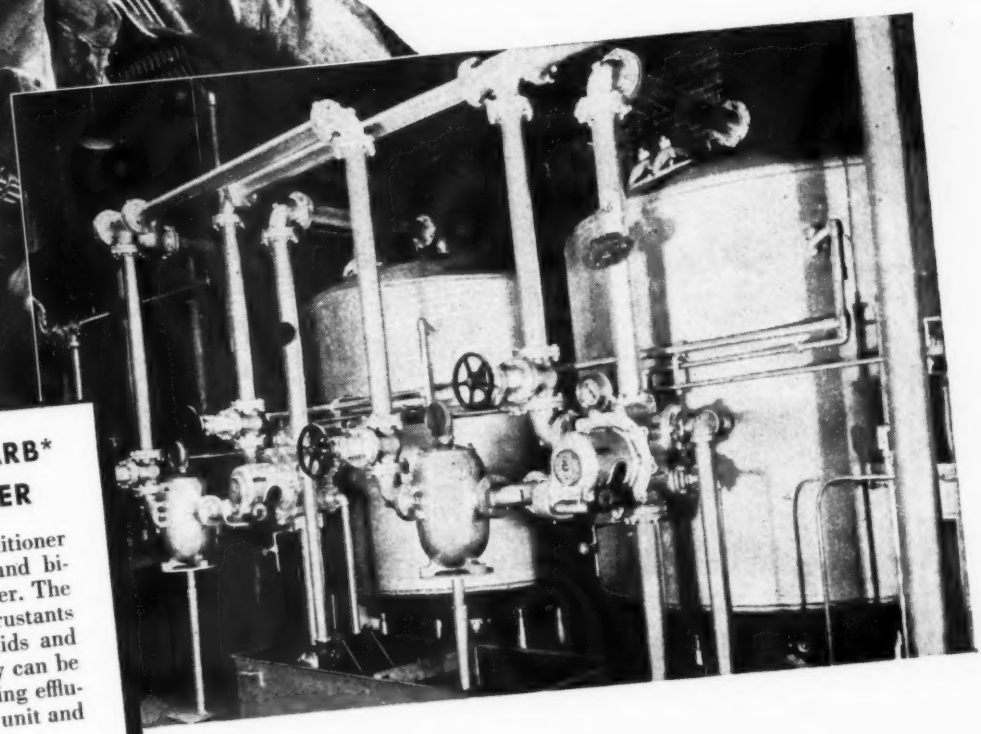

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Zeo-Karb H water conditioner removes both hardness and bicarbonates from raw water. The effluent contains no incrustants—is reduced in total solids and alkalinity. The alkalinity can be made as desired by mixing effluents from a Zeo-Karb H unit and a sodium Zeolite unit.

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Permutit makes *every type* of equipment for better water conditioning. Other processes include hot lime soda softeners, deaerating heaters, the new Demineralizing Process, silica removal and continuous blow-off equipment.

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ONE-MAN OPERATION

. . . saves time and labor with ROTO TUBE CLEANERS

No helper is needed with a Roto Tube Cleaner. One man can handle a tube cleaning job by himself with the convenient Roto Operating Air Valve on the motor.

Roto one-man operated tube cleaners will help to eliminate power losses and step up the capacity of your plant by descaling your tubes much faster than with old type cleaners.

Roto Tube Cleaners are available for all sizes and shapes of tubes, for operation with air, steam or water. Send for details.

Roto Model 135 air-driven motor with swing-frame head and air valve for one-man operation.

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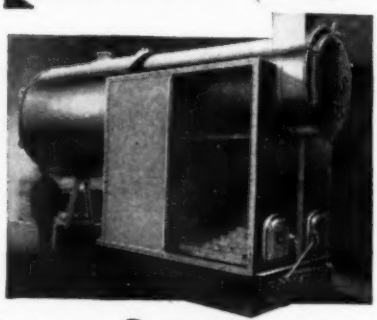
HI-TEST KEWANEE

FOR POWER and PROCESS STEAM

An all-welded, portable, quick steaming type with refractory lined firebox and two-pass tubes to save more fuel. 6 sizes...50 to 150 hp. 125 & 150 lbs. WP.

For 6" scale with pipe diameter markings, Write Dept. 89K-VIII.



KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS • Division of AMERICAN Radiator and "Standard" Sanitary Corporation

be misleading, as far as revealing the true condition of the piston rings. As JG's compressors are several years old and the load is increasing, it will be more economical to install new rings. He should check the clearance between piston and cylinder, also the cylinder for scoring.

New York, N. Y. J J Foy

Inlet May Be Restricted

THERE IS A POSSIBILITY that JG has piston-ring leakage in his compressor. If so, the indicator diagram will appear as in Fig. 1. An ideal card appears in Fig. 2.

Then again it is possible that several other conditions exist, of which he is unaware. For instance, the inlet valve may be closing late, inlet openings may be restricted, inlet may be opening late, indicator pipe may be blocked giving a false reading, or inlet valve may be opening early. Sometimes the discharge areas are restricted, or discharge valves may be leaking.

Indicator cards should be taken only after the compressor has been operated long enough to get thoroughly warmed up. (At least an hour).

In computing the work done in the cylinder, and the mean effective pressure throughout the stroke, the entire area enclosed by the diagram *ABCD* must be used. It can be measured by a planimeter or by using ordinates. This area, of course, represents only the work done in one stroke of a double-acting compressor cylinder. Better accuracy is obtained by basing deductions upon the mean of cards from both ends of the cylinder.

The area *AA'RD*, lying below the atmospheric line, represents the resistance on the return stroke. It is assumed that the cards from both ends of the cylinder are similar, therefore, this area may be safely considered in connection with the area above the atmosphere line for the single stroke.

GH is the line of zero pressure which is drawn at the proper distance below the atmospheric line, *EF*, according to the scale. *DA* is the admission or intake line; *AB*, the compression line; *BC*, the delivery or discharge line; and *CD*, the re-expansion line. Notice that the admission line *DA* is drawn at an exaggerated distance below the atmospheric line *EF*, so it is clearly seen. In the best practice, these two lines so nearly coincide as to be hardly distinguishable. The line *CO* is dropped vertically from the point *C*; the distance *EO* represents the stroke of the

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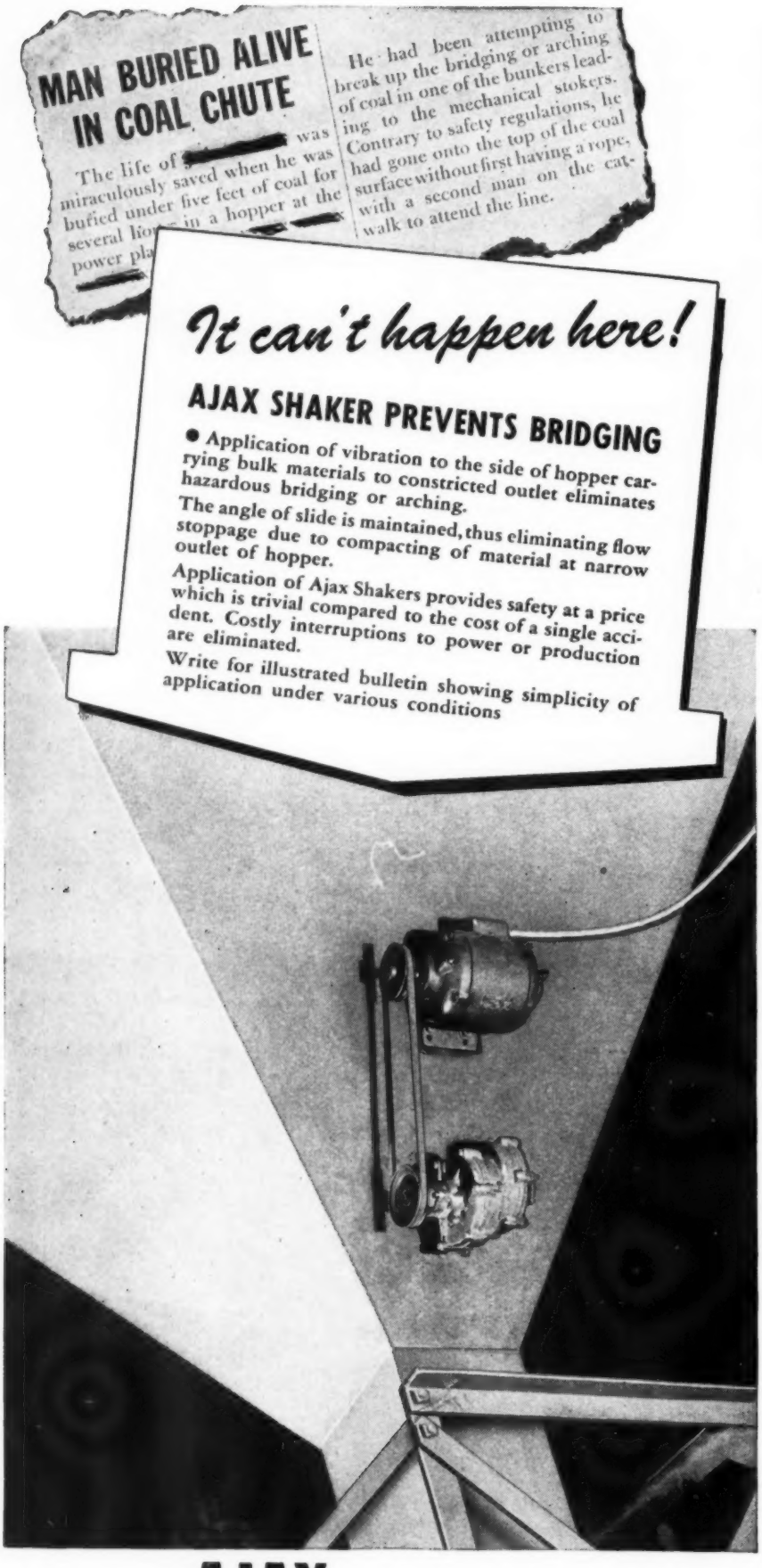
MAN BURIED ALIVE IN COAL CHUTE
The life of [redacted] was miraculously saved when he was buried under five feet of coal for several hours in a hopper at the power pla[redacted]
He had been attempting to break up the bridging or arching of coal in one of the bunkers leading to the mechanical stokers. Contrary to safety regulations, he had gone onto the top of the coal surface without first having a rope, with a second man on the catwalk to attend the line.
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piston. The line *CO* (or *PR*) represents the maximum gage pressure.

The rectangle *ENCO* represents the actual volume displaced by the piston in moving from *E* to *O*. This, however, is not the total capacity of the cylinder, for, at the end of the stroke, there still remains a small volume, which is represented by the rectangle *OCKJ*, in the clearance space of the cylinder. This small volume is compressed, of course, to maximum pressure. On the return stroke, it expands to atmospheric-pressure along the curve *CD*, its expansion occurring so quickly as to be practically adiabatic. Therefore the total volume of air acted upon by the piston is represented by the rectangle *ENKJ*. The distance *OJ* (or *CK*) represents the clearance.

Since compression began a little below atmosphere, it will be noted that the compression line *AB* intersects the atmosphere line *EF* at *A'*, which, being the point at which compression from atmosphere begins, may be taken as the initial point of the entire cycle of operations represented in the diagram.

When the piston is at the end of its stroke, there still remains the air at terminal or discharge pressure in the clearance space represented by *OCKJ*. This volume, while not delivered or discharged, and having required an expenditure of power to compress it, gives back this power by its re-expansion, helping the piston on its return stroke.

The point *A'* where the compression line crosses the atmosphere line, indicates that the cylinder is full of air at atmospheric pressure at this point in the stroke. The distance *EA'* represents the portion of the stroke required to compress to atmospheric pressure the rarefied air indicated by the intake line. This distance is usually deducted from the full stroke *EO* as non-effective in the compression and the delivery of atmospheric air under pressure. This emphasizes the importance of bringing the intake line as near as possible to the atmosphere line, as the distance *EA'* evidently increases as the intake line drops below atmosphere.

The distance *RO* represents the proportion of the stroke occupied in compressing and re-expanding the clearance air. It is non-effective in the admission of atmospheric air, and it also must be deducted from the full stroke *EO*.

The indicator card will show accurately the ratio of air volume compressed and discharged to the cylinder displacement, but does not take into consideration the temperature losses involved.

Fairview, N. J. M N GOZDENOVICH

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(and more than 120 others)

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2 Outer felted asbestos insulation impregnated with heat, flame and moisture resisting compounds. Acts as a heat-barrier against high ambient temperatures.

3 Lubricated varnished cambric for high dielectric strength and high moisture resistance, protected from heat, flame and oxidation between two felted asbestos walls.

4 Dense felted asbestos insulation impregnated with heat, flame and moisture resisting compounds will not dry out, bake brittle or crack with vibration. Withstands conductor-heating overloads and won't burn even when exposed to copper-melting arcs.

5 The conductor is *perfectly* and *permanently* centered in helically applied insulation that stays put and will not migrate or flow under the action of heat, oil, grease, etc.

RESISTS moisture, oil, grease and fumes
WON'T bake brittle, burn, flow or rot

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Underwriters' and N.E. Code, Type AVA—maximum operating temperature 110° C.

Permanently insulated Rockbestos A.V.C. wires, cables and cords, developed for trouble-free operation under severe operating conditions such as in circuits that run around steel mills, soaking pits, hot forging presses, boilers, steam tunnels, etc. are available in a wide range of sizes and types. Special wires for unusual applications will be designed to meet your requirements. Rockbestos Research will gladly assist you in the selection of the right wire for that difficult wiring problem. Write nearest branch office or:

Rockbestos Products Corp., 907 Nicoll St., New Haven, Conn.

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The Wire with Permanent Insulation

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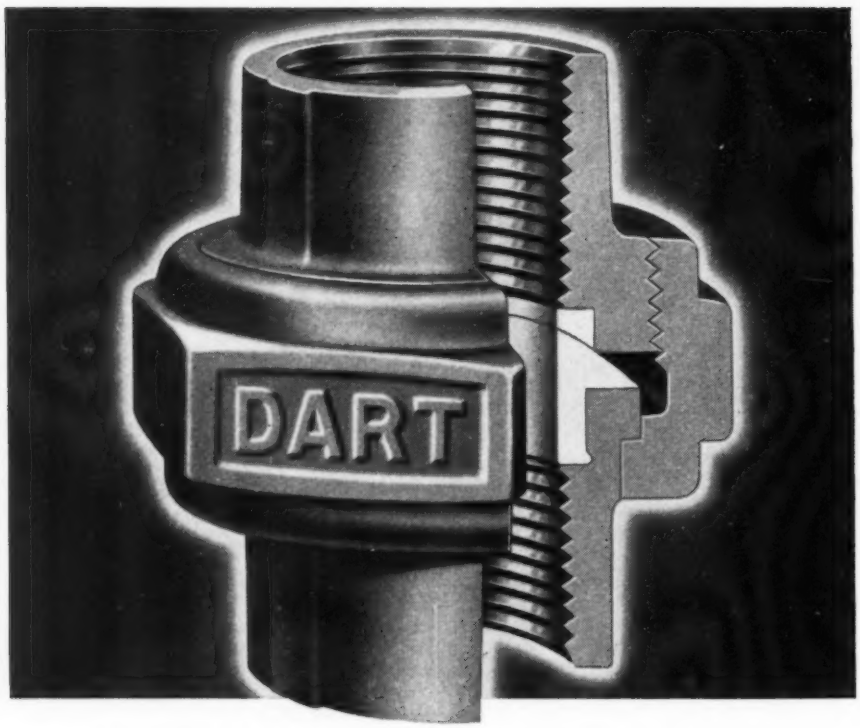
TEAM UP

Your Old DART UNIONS with New Ones



. . . For Used Darts Can Be Put Back To Work

Here's a well-proven formula for conserving vital metals and helping to win the production war. *Search out the old Dart Unions around your plant and put them back on the job with new ones . . .* for, old and new Darts work swell together.

You see, "old-time" Darts will make up tight quickly . . . and *stay* tight—like new Darts. And here's the explanation of *why* Darts can be used so many times with complete satisfaction: matched bronze seats, ground to "true-ball" surfaces; High Test Air Refined Malleable Iron Nuts and Bodies that resist pipe strains and rough handling.

So, if you have any idle used Darts, put them back to work. And if you need new Darts, see your supplier.

DART UNIONS

E. M. DART MFG. CO., PROVIDENCE, R. I.

Engineers' Books

(*Continued from page* 124)

This one, in the field that it covers, presents the subject in simple practical language that the man in the shop can understand. It is a simple and practical manual explaining the construction and operation of the tubes and circuits used to control resistance welding equipment in industrial plants for the aid of men who work with and maintain these controls. Electron tubes and their circuits are described, giving simple electrical background along with detailed explanations and diagrams of most tube circuits, including synchronous timers and stored energy controls. It shows how and why the tubes work in their circuits, in a treatment that starts with the picture of the complete welder control in service, and adds detailed fundamental background as the need arises in the study of specific devices. The work is divided into three parts: ignitron contactors, tubes and weld timers; synchronous control of ac welding; and energy-storage welding. These subjects the author has taught to classes attended by hundreds of men working in war industries. From these men he has learned the information they need and has presented it with a clear understanding of his reader's limitations in technical attainments. Many of the explanations of tubes and circuits are basic, consequently apply to electronic control in general, therefore the book will be useful to everyone interested in electron tubes and circuits.

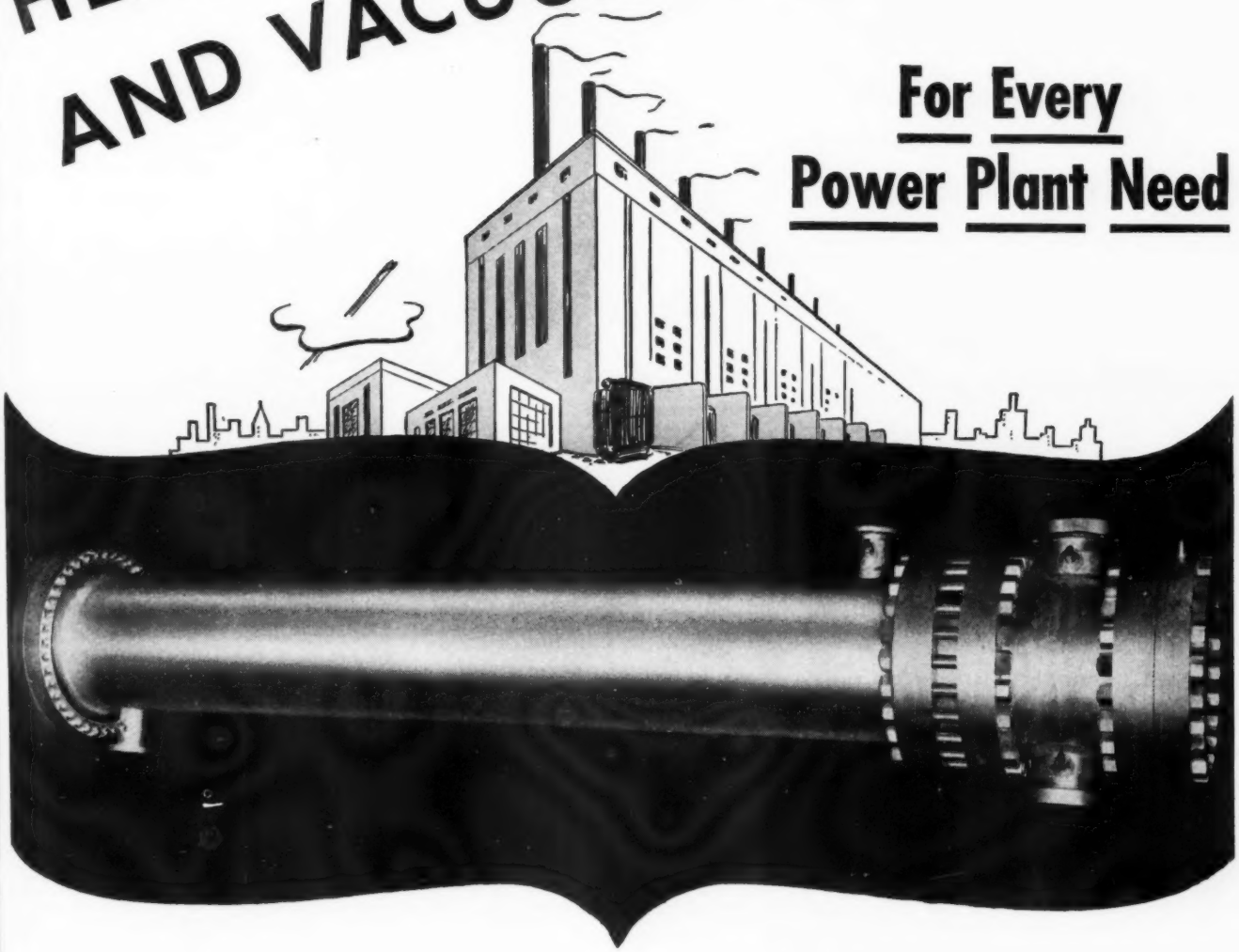
Brief Reviews

MECHANICAL WORLD YEARBOOK (1943) *published by Emmott & Co, Ltd, 78, Palatine Road, Manchester 20, England.* The 1943 edition contains material and information on the light metals and alloys which play an important part in modern warfare. Also contains usual sections on price equivalents, British weights and measures, pressure and head of water, index to contents, and other data in addition to the revised section on the light alloy mechanical press work, electric welding, etc.

RECOMMENDED PRACTICES FOR THE SPOT AND SEAM WELDING OF LOW-CARBON STEEL. *Published by the American Welding Society, 33 West 39th St, New York, N. Y. 4 page leaflet, 6x9 in., price 10 cents.* The bulletin is com-

HEAT INTERCHANGE AND VACUUM EQUIPMENT

For Every Power Plant Need



As a major producer of heat interchange equipment, Lummus designs and builds a complete line of

★ Surface Condensers
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★ Bleeder Heaters
★ Boiler Blowdown Heat Exchangers
★ Evaporators
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The services of Lummus engineering personnel are available to public utilities and industrial power plants for the study of specific problems and the design of heat exchange and vacuum equipment to meet individual conditions.

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LUMMUS

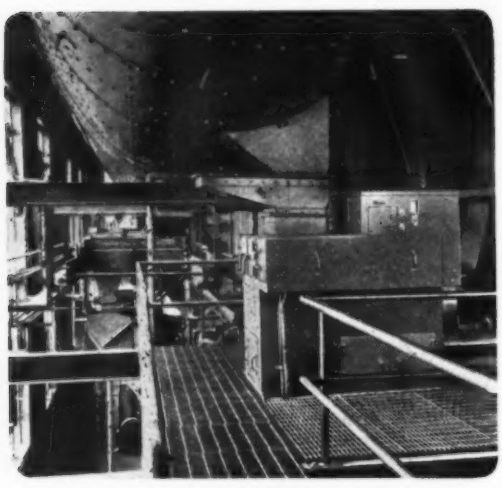
CAN YOU CUT YOUR POWER BILL?

Base your answer on fact—on known boiler efficiency. This is easily and accurately determined with the aid of

Richardson

AUTOMATIC COAL SCALES

Their precise figures on coal consumption enable you to compile dependable evaporation tables for any grade of coal under test. From these tables it's a simple matter to compute the cost per thousand pounds of steam. Comparisons of these costs show beyond doubt whether it's feasible to use cheaper coal in your boilers.



Richardson Automatic Coal Scale of 12 tons per hour capacity, supplied complete with bunker gate fed from overhead bunker and discharging to mechanical stoker.

Known boiler efficiency also tells when a boiler is consuming too much fuel. Savings of 10% on coal bills are common where Richardson Coal Scales are working. Power engineers like their continuous accuracy, the way they weigh and record without attention, and their dust-proof construction. Models can be equipped with elongated conveyors that eliminate extra equipment and save headroom. For details, send for catalog 1143. Contains 46 pages of illustrations and technical data.

RICHARDSON SCALE COMPANY

CLIFTON, NEW JERSEY

4330

posed essentially of two charts, one each for spot and seam welding together with an explanation for their use. The bulletin represents the best information available at this time on spot and seam welding of low carbon steel and is therefore recommended as standard practice during the war emergency, according to the welding society.

MANPOWER. *Published by the Research Institute of America, 292 Madison Ave, New York, N. Y. Paper bound, 92 pages. Available to members.* Presents data on manpower during this war answering such questions as: are you essential, which employees will be in uniform, and presents replacement schedules, manning tables and hiring controls. Also contains a section on how to use the U. S. Employment Service.

MINERAL WOOL; Loose, Granulated or Felted Form, in Low Temperature Installations (Commercial Standard CS105-43). *Single copies may be obtained free on request from the Industrial Mineral Wool Institute, 441 Lexington Ave, New York, N. Y.* This is the first commercial standard ever promulgated on mineral wool industry products. The standard covers both cold storage area and pipe line mineral wool insulation. Based on extensive research by fully qualified engineers comprising the Institute's Specifications Committee, it also includes recommendations by engineers of the refrigeration field generally.

RADIO DATA HANDBOOK. *Edited by Lieut Nelson M Cooke, United States Navy, U. S. Naval Research Laboratory, Washington, D. C. Published by Allied Radio Corp, 833 West Jackson Blvd, Chicago, Ill. 48 pages, 6x9 in. Price, 25 cents.* A comprehensive condensed handbook of formulas, charts and data most commonly used in the field of radio and electronics. Divided into four parts: Mathematical data, radio and electronic formulas, engineering and servicing information, and a complete set of four-place log and trig tables.

COMPANY MUSEUMS—*By Laurence V Coleman, director of the American Association of Museums. Published in 1943 by the American Association of Museums, Washington, D. C. 174 pages, cloth bound. Price, $2.50.* Main purpose of this book for business men is to show the nature and usefulness of company museums. Also may serve as a guide for those who have to manage museums of the kind described.

A copy of this United Nations poster, measuring 24"x 37" will be sent (while the supply lasts) to anyone who requests it on a company letterhead. Write to Koppers Company, Dept. A, Pittsburgh (19), Pa.

KOPPERS

THE INDUSTRY THAT SERVES ALL INDUSTRY

MORE PROOF THAT IT IS MORE ECONOMICAL TO GENERATE YOUR OWN POWER

SCHOOL

Famous college in New York City. Four horizontal "UNIVERSAL UNAFLOW" Steam Engines, with 3-wire D-C generators of 1100 kw. total capacity. Steam pressure 150 psi., sat.; back pressure 0-5 psi. Installed 1923, 1938. Exhaust steam used for building heat.

DAIRY

Nationally-known milk plant in Chicago, Ill. Two horizontal "UNIVERSAL UNAFLOW" Steam Engines; one driving 250-kv.a., 3-ph., 60-cy., 240-v. A-C generator, belted exciter; one rated 240 hp., driving horizontal ammonia compressor. Steam pressure 150 psi., sat.; back pressure 0-3 psi. Installed 1928. Exhaust used for building and water heating.

CONFECTIONERY

Large candy manufacturer in St. Louis, Mo. Two horizontal "UNIVERSAL UNAFLOW" Steam Engines, driving 375-kv.a., 3-ph., 60-cy., 208/120-v., 4-wire A-C generators, with V-belted exciters. Steam pressure 150 psi., sat.; back pressure 0-7 psi. Installed 1928. Exhaust steam used for building heating and refrigeration.

BREWERY

Well-known brewery in Cincinnati, Ohio. Three horizontal "UNIVERSAL UNAFLOW" Steam Engines, with 125-v. D-C generators; one 125 kw. (1937) and two 200 kw. (1942). Steam pressure 115 psi., sat.; back pressure 0 psi. or condensing.

with SKINNER "UNIVERSAL UNAFLOW" STEAM ENGINES

TODAY, the availability and assurance of an ample supply of electric power frequently surpasses in importance the cost of obtaining it. *Tomorrow*, the cost of power will be a deciding factor in the profitable operation of any business.

Skinner engines have been installed in practically every known industry. In addition to enjoying a dependable power supply, the users of Skinner "Universal Unaflow" Steam Engines pictured here, like hundreds of others, are further benefited. By generating their own electric current instead of buying it, these owners have saved, and will continue to save, thousands of dollars in annual power costs.

What we have done for others, we can probably do for you. Selection of the proper size and type of "the most economical steam engine built" may be made for your particular requirements. Now is the time to think about and plan for post-war power. Our research and engineering departments are available now to discuss your plans for the future.

INVEST TODAY IN BONDS FOR VICTORY

COLLIERY

Modern coal mining plant in West Virginia. Two horizontal "UNIVERSAL UNAFLOW" Steam Engines, driving 750-kv.a., 3-ph., 60-cy., 2300-v. A-C generators, with V-belted exciters. Steam pressure 160 psi., sat.; back pressure 0-2 psi. Installed 1933.

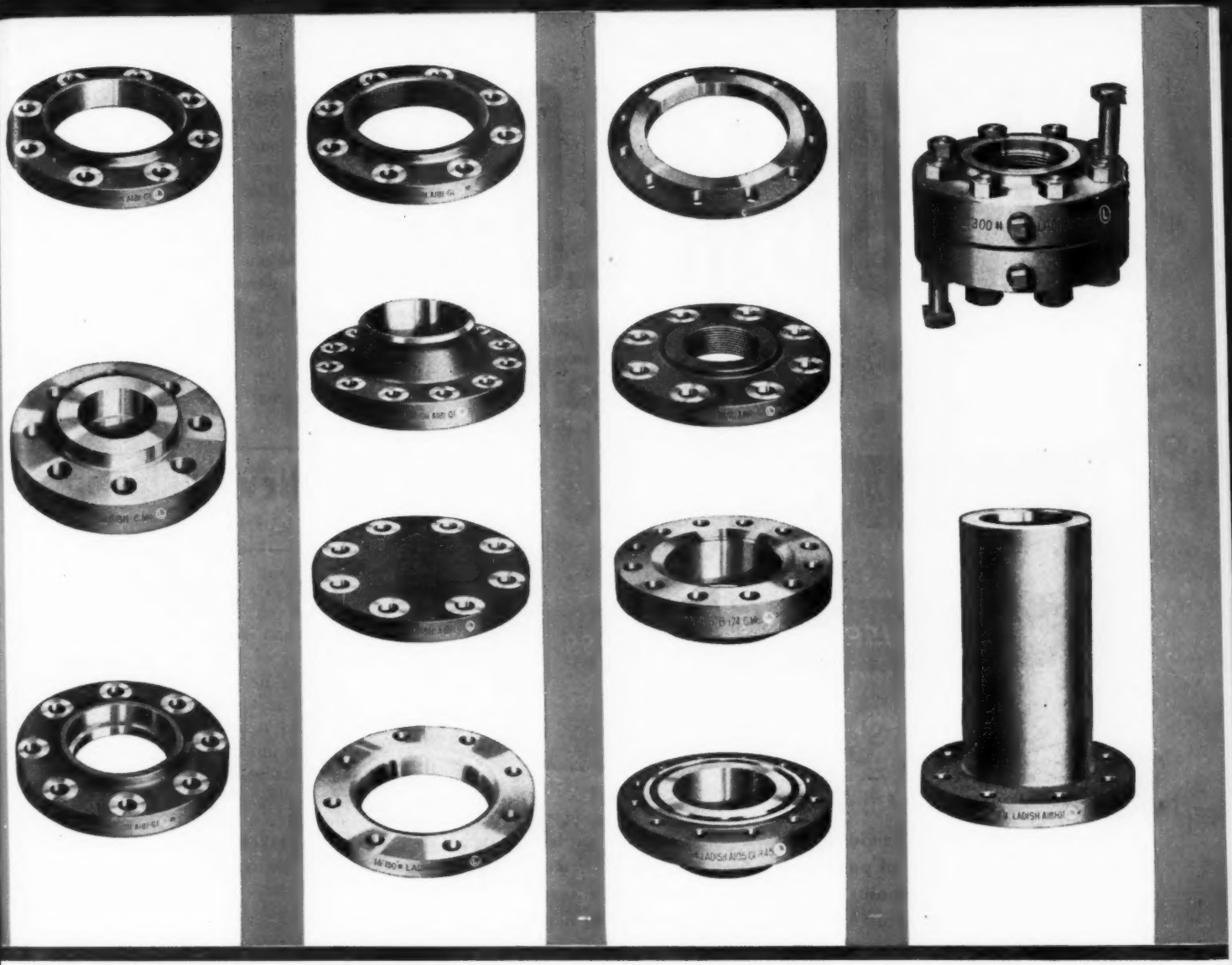
Army-Navy "E" Flag

Proudly we fly the Army—Navy "E" Flag, awarded for excellence in production

Our production facilities, at present, are devoted entirely to building Skinner Unaflow Steam Engines for the war program.

Our Seventy-fifth Anniversary 1868 - 1943

SKINNER ENGINE COMPANY FOUNDED IN 1868 **ERIE, PA.**



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● **Ladish Forged Steel Flanges are produced under constant and extensive metallurgical control. Our unexcelled facilities assure uniform quality forgings that meet the most exacting engineering requirements.**

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LADISH DROP FORGE CO.

CUDAHY [MILWAUKEE SUBURB] WISCONSIN

VACUUM LOSS

VACUUM LOSS in your condenser due to a little slime may be of paramount importance. Even thin deposits may reduce heat transfer 25%; cost hundreds of tons of extra fuel each month; cause equipment outage at a period of critical loading.

More frequent blowing or plugging is a costly and unsatisfactory answer, even where the manpower or excess generating capacity is available. Sliming conditions often become critical just when load conditions prevent taking a unit off the line.

WALLACE & TIERNAN INTERMITTENT DESLIMING PROCESS has permanently solved slime problems in scores of plants where circulating water was so bad that condensers lost one-half inch of vacuum over night. In many cases, condensers are maintaining vacuums consistently ABOVE manufacturers guarantees, even above any previous performance of the units.

Now, plants with less severe slime problems are finding that the treatment quickly pays for itself in fuel savings without considering the gain due to lowered outage and labor costs of cleaning.

Why not let W&T Engineers furnish facts and figures that fit your situation.

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Manufacturers of Chlorine and Ammonia Control Apparatus

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ELECTRICAL YEARBOOK (1943) *published by Emmott & Co, Ltd, 78, Paltine Road, Manchester 20, England. 337 pages, cloth bound.* In this edition of the Electrical Yearbook the section on dynamo and motor defects has been completely rewritten so as to include and be most applicable to the types now commonly used. The sections on control gear and switchgear and switchboards have been revised and further matter added to those on meters and measuring instruments and speed and speed control of ac motors.

New Equipment

(*Continued from page* 126)

placed over the test rod and connected to test clips. The dials on the galvanometer control panel are set to the number of turns the coil should have and the foot switch is pressed. If the galvanometer dial shows a deflection, the dial readings are increased or decreased until the deflection is zero. The dial reading is then the number of turns. When the probable number of turns in a coil is not known a trial reading is taken and the dial is adjusted until the reading is zero on the galvanometer. *General Electric Co, Schenectady, N. Y.*

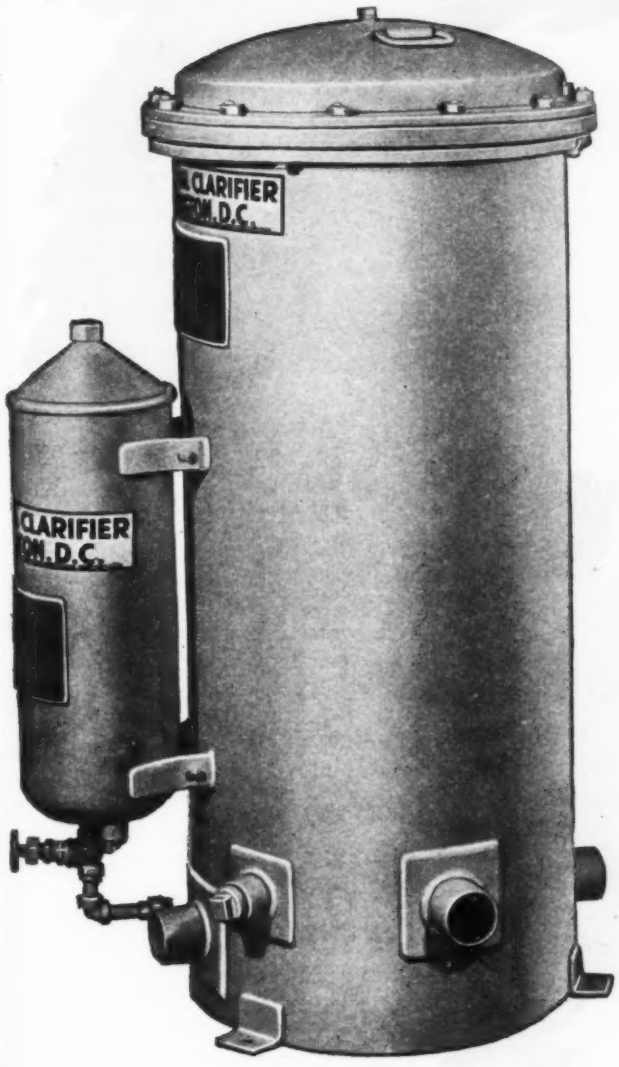
Wetting Agent

KLEEN-KOL is wetting agent added to water to lay coal, coke and ash dust. The concentrate, when added to coal spraying water, is claimed to produce rapid dispersion of the liquid over and through the coal pile, wetting and precipitating all dust particles where water alone would be ineffective. Simple siphon arrangement available for the standard 3¼-in hose to feed the concentrate into the hose stream at the recommended dilution. *Sterling E Norcross, 35 Walnut St, Bloomfield, N. J.*

Constant Delivery Dual-Vane Pumps

CONSTANT DELIVERY HYDRAULIC VANE PUMPS are designed especially for high-pressure operation with unusually high operating efficiencies, according to maker. Available in three sizes to give from 2½ to 60 gpm, pumps are of dual-vane design which permit operation under high pressures without overheating, with reduction in wear. Design also said to allow the pumps to withstand line surge without damage. Maximum continuous operating pres-

Now I KNOW this oil is 100% clean!



100 PER CENT OF THE TIME

Because the engine is equipped with a *NEW* Briggs 100% Flow Oil Filter-Clarifier . . . assuring 100% engine protection.

This new Filter-Clarifier does a dual job!

100% of the oil flows through a special absorbent cellulose refill. Dirt, carbon and other harmful abrasives are effectively removed.

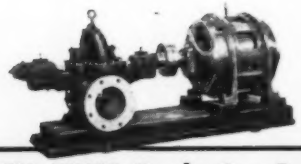
Then . . . it *PURIFIES* the oil 100%. Engine lubricating oil, after filtration, is by-passed through a Clarifier mounted on the side of the filter tank. This Clarifier contains a Briggs molded Block refill which removes dangerous engine-corroding acids and sludge forming gums.

Thus, the Briggs Clarifier Company has set another precedent in oil maintenance equipment with . . .
100% Filtration • 100% Purification • 100% Efficiency

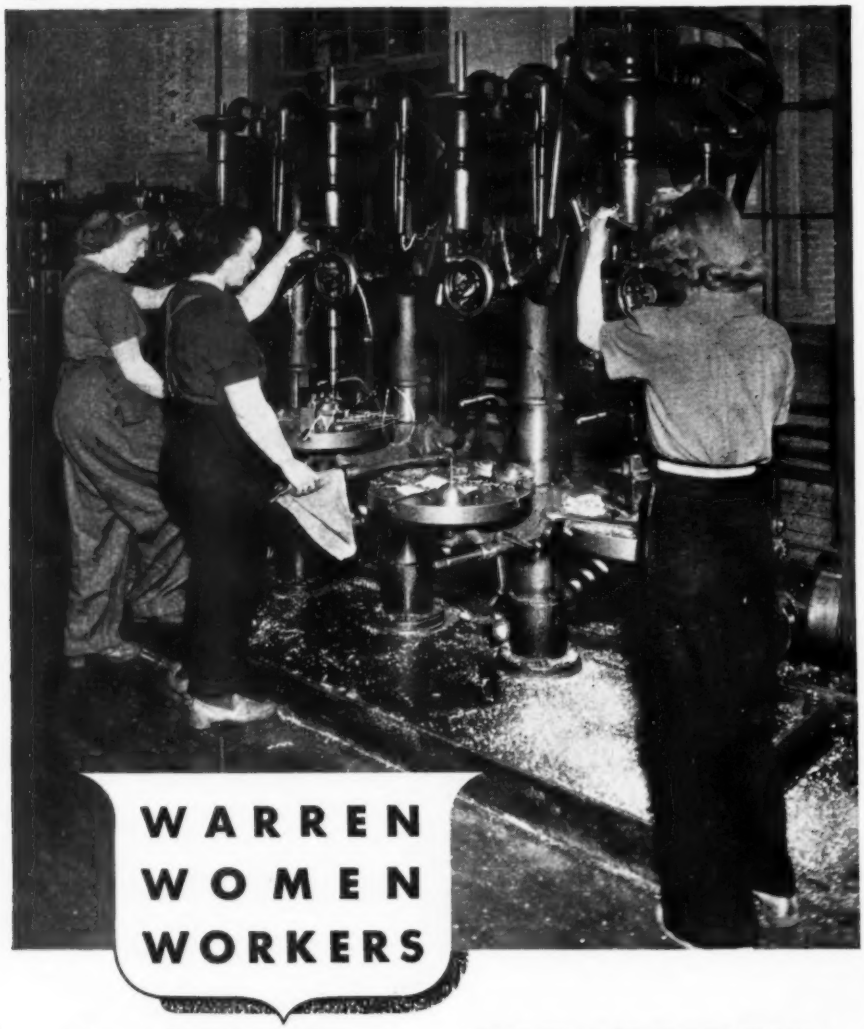
COMPLETE OIL MAINTENANCE EQUIPMENT FOR DIESELS • TRANSPORT • TRUCKS • AIRPLANES • TRANSFORMERS • MACHINES

BRIGGS CLARIFIER CO.

1339 WISCONSIN AVENUE, N. W., WASHINGTON, D. C.



Fighters on the WARREN PUMP Production Front. No. 5 of a Series



do their bit . . . FOR VICTORY!

No glamor . . . no fanfare to the job of machining small pump parts . . . or to many other types of work now being successfully performed by women in the plant of the Warren Steam Pump Company. Carefully trained and supervised by veteran Warren workmen, these women apply themselves diligently to the tasks at hand . . . not unmindful of the reputation that Warren Pumps have always enjoyed for efficiency, reliability and economy. Their contribution to our all-out war effort is real . . . substantial . . . patriotic.

WARREN SALUTES ITS WOMEN WORKERS!

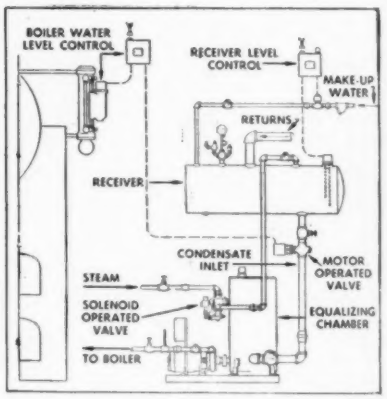
WARREN PUMPS

WARREN STEAM PUMP COMPANY, INC.
WARREN, MASSACHUSETTS

sure of the standard pumps is 1250 psi but pressures as high as 2000 psi can be handled by the pumps for prolonged periods without damage or overheating. Dual vanes counterbalance the total outward pressure on the vanes and are said to prevent overheating and wear even at excessively high pressures. Each of the two vanes is ground with a bevel so that oil under full operating pressure can reach the outward edge of each pair of vanes. This back or counterbalancing pressure can be varied by changing the angle at which the vanes are ground so that the vanes are held against the stator with only the necessary amount of pressure to effect an adequate seal. *Hydra-Motive Division, 723 East Milwaukee Ave, Detroit, Mich.*

Boiler-Feed Systems

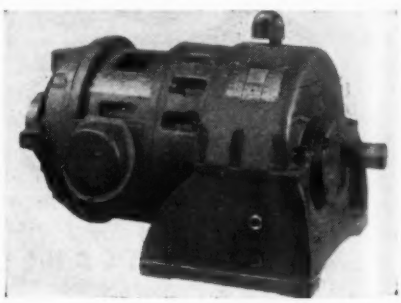
JOHNSON HIGH-TEMPERATURE boiler-feed system expansion announced. All sizes now available with either a standard coupled pump or the close-coupled



unit originally furnished. In addition, a new larger size of the pumping unit has been developed, making the system available now for use with boilers from 30 to 500 hp operating at pressures up to 150 psi. *Johnson Corp, Three Rivers, Mich.*

Gearmotors

NEW LINE of horizontal parallel-shaft gearmotors which meet speed reduction requirements over a range of 1 to 75 hp announced. Use of adaptor castings



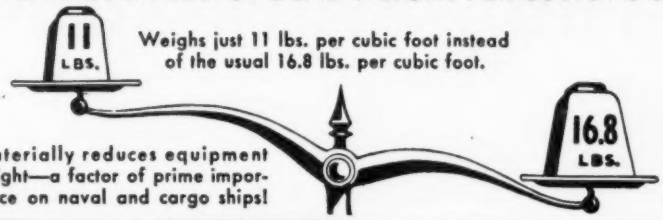
New, Patented* PLANT PRECISION MOLDED process

ACHIEVES UNPRECEDENTED LIGHT WEIGHT

in 85% MAGNESIA HEAT INSULATING MATERIAL!

So light that anyone can lift it—and so revolutionary that it re-writes all present-day standards of heat-insulation efficiency! Here for the first time is a new, amazing, patented process that capitalizes upon the time-tested insulation values of 85% Magnesia, bringing unprecedented advantages — not only in lightness, but also in lower thermal conductivity; controlled uniformity; greater "ductile strength"; durability, precision pipe fit, and other long-wanted factors. Detailed descriptive material sent upon your request.

ELIMINATES 5.8 LBS. OF DEAD WEIGHT PER CUBIC FOOT



Weighs just 11 lbs. per cubic foot instead of the usual 16.8 lbs. per cubic foot.

Materially reduces equipment weight—a factor of prime importance on naval and cargo ships!

PLANT PRECISION MOLDED
REG. U. S. PAT. OFF.
85% MAGNESIA
"THE DEPENDABLE STANDARD—MODERNIZED"

*U. S. Patent Nos. 2,131,374, 2,209,752, 2,209,753, 2,209,754

GOES ON FASTER!
Even the larger, thicker sizes are easier to handle and apply—no matter how cramped the installation may be!

INSULATION EFFICIENCY approximately **29% BETTER**

than any comparative thickness of heat insulating material weighing 16.8 lbs. per cubic foot, as proved by impartial tests over a full range of temperatures!

Buy U. S. WAR BONDS

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Manufacturers of Plant Insulating Materials and Mechanical Packings Since 1920

MAIN OFFICE: SAN FRANCISCO

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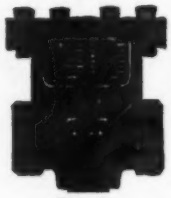
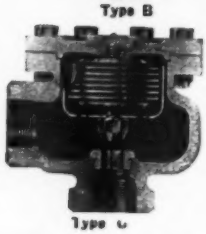
★ No Water Logged Units
★ No Adjustment Needed
★ No Air-Binding
★ No Freeze-Ups
★ No Dribbling

Type AU



Type B



Type C

5 BIG ADVANTAGES OFFERED USERS OF NICHOLSON *Thermostatic Industrial* TRAPS

All types drain completely and automatically . . . same adjustment used for any pressure, vacuum to maximum allowable . . . discharge air as efficiently as water . . . complete drainage when cold prevents freezing . . . closes immediately when steam contacts bellows. Five types, sizes ¼" to 2", pressures up to 300 lbs. Bulletin No. 242.

Also

INVESTIGATE THE ADVANTAGES OF INSTALLING THESE OTHER NICHOLSON SPECIALTIES

Super-Pressure Piston and Weight Operated Traps

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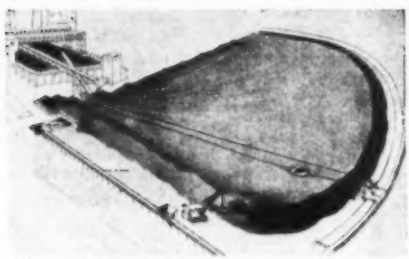
THERMOSTATIC ▼ PISTON AND WEIGHT-OPERATED STEAM GASOLINE AND COMPRESSED AIR TRAPS ▼▼▼

CONTROL VALVES ▼ FLOATS ▼ MANDRELS ▼ STEAM AND AIR SEPARATORS

STORE MORE COAL - - -



Above sketch shows a 2 cu. yd. Sauerman Scraper with mobile tail tower. The scraper handles 100 tons per hour and has piled 50,000 tons on a quarter circle area within its 350 ft. radius.

Here is a Sauerman unit using a tail bridle instead of a tail tower. This ¾ cu. yd. scraper handles up to 450 tons per day; piles 8,000 tons on small space.

the safe, economical

SAUERMAN way

Increased fuel storage is one of the "musts" in the war production program. Plants that once were satisfied to carry a month's supply of coal now look upon four to six months' supply as a minimum.

You can increase your present coal storage capacity economically, regardless of the shape or size of the available ground area, with a Sauerman Power Drag Scraper.

This machine is able to pile a larger tonnage safely on a given space because it stacks the coal layer upon layer to form a homogeneous pile that avoids segregation. Such a pile is practically safe from any danger of spontaneous combustion.

Write today for useful catalog

SAUERMAN BROS., Inc.

562 S. Clinton St., CHICAGO

between motor and mechanical parts allows the use of all standard Westinghouse NEMA frame motors with each type of unit and types of motor construction can therefore be readily changed to suit varying service conditions if necessary in the field. Gears and pinions in the new gearmotors are of .40-.50 carbon steel and are given special heat-treatment before hobbing. *Westinghouse Electric & Mfg Co, East Pittsburgh, Pa.*

Slide-Wire Rheostat

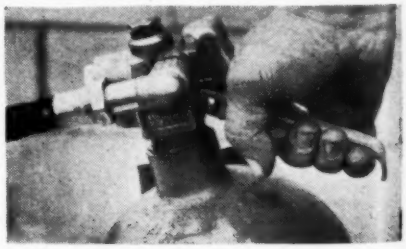
DESIGNED ESPECIALLY for low resistance low wattage applications. Length of resistance wire is stretched tightly around the outside of a cylindrical core which is bonded to a ceramic base. Wire is anchored firmly to two terminals. Contact to the wire is made by a phosphor-bronze spring arm which is connected to a third terminal. The three terminals allows the unit to be used as a potentiometer or voltage divider. The maximum resistance which can be supplied on this unit is approximately 1 ohm while the minimum total resistance can be made approximately 0.1 ohm. Since the contact arm travels along the wire from end to end, the resistance variation is stepless. *Ohmite Mfg Co, 4835 West Flournoy St, Chicago, 44, Ill.*

Tracing Cloth

IMPROVED WHITE PENCIL tracing cloth is moisture resistant on both sides. This is said to be important and helps to guard against spots from perspiration of moist hands. In many parts of the country the moisture resistant surfaces are a safeguard against climatic conditions. *Frederick Post Co, Box 803, Chicago.*

Fire Extinguisher Valve

SQUEEZ-GRIP VALVE for carbon-dioxide fire extinguishers operates by a lever directly over the carrying handle of the extinguisher. By merely applying pressure or squeezing with one hand,



the valve is opened and the gas discharged. On release of pressure, the valve closes and the gas discharge is

Why We Are Advertising Now

Surely, not to get more immediate business. Our entire facilities are devoted solely to the war effort. Our combined engineering experience and production ability is centered on one objective:... winning the war.

For decades the names Hendy, Pomona and Crocker-Wheeler have been familiar to you. That these names may be kept fresh in your mind until the war is won and we can again solicit your business, is the reason we're advertising now... telling you about our facilities, the products we're making, the personnel of the Hendy organization and such other things as we can publish without jeopardizing the war effort.

THE IRON MEN OF HENDY
...are now producing marine steam engines, steam turbines, and reduction gears; electric motors, fractional to 10,000 h.p.; generators, 3 to 7,500 KW; hydraulic pumps with capacities from 50 to 6 million gallons per hour... all exclusively for the war effort.

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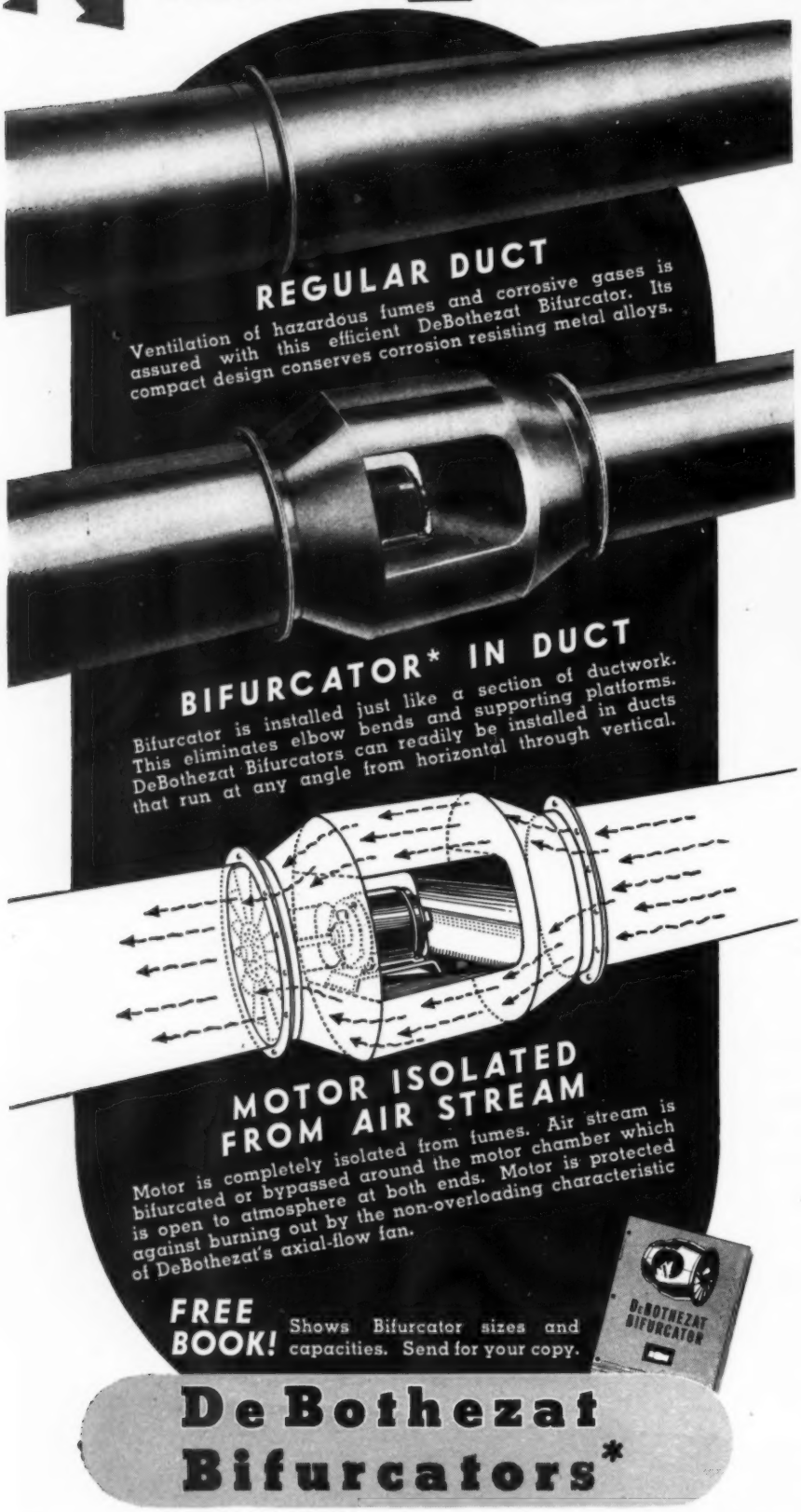
SUNNYVALE · CALIFORNIA

Divisions: POMONA PUMP COMPANY
CROCKER-WHEELER ELECTRIC MFG. CO

Manufacturing Plants: SUNNYVALE, LONG BEACH, POMONA and TORRANCE in CALIFORNIA • AMPERE, N. J. • ST. LOUIS, MO.
Branch Offices: NEW YORK • WASHINGTON • PHILADELPHIA PITTSBURGH • CHICAGO • ST. LOUIS • SAN FRANCISCO • LOS ANGELES

This DIFFERENT TYPE VENTILATING UNIT* *installs in the Duct*


REGULAR DUCT
Ventilation of hazardous fumes and corrosive gases is assured with this efficient DeBothezat Bifurcator. Its compact design conserves corrosion resisting metal alloys.
BIFURCATOR* IN DUCT
Bifurcator is installed just like a section of ductwork. This eliminates elbow bends and supporting platforms. DeBothezat Bifurcators can readily be installed in ducts that run at any angle from horizontal through vertical.
MOTOR ISOLATED FROM AIR STREAM
Motor is completely isolated from fumes. Air stream is bifurcated or bypassed around the motor chamber which is open to atmosphere at both ends. Motor is protected against burning out by the non-overloading characteristic of DeBothezat's axial-flow fan.
FREE BOOK! Shows Bifurcator sizes and capacities. Send for your copy.
DeBOTHEZAT BIFURCATOR

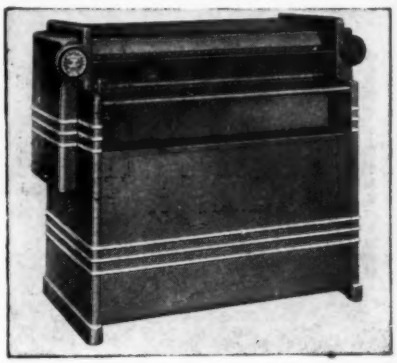
De Bothezat Bifurcators*

DE BOTHEZAT DIVISION of AMERICAN MACHINE AND METALS, INC., EAST MOLINE, ILLINOIS

cut off. The valve can be opened and closed without setting down the extinguisher, which must be done when a handwheel valve is used. On closing, the valve is forced tightly against its seat by the tremendous gas pressure in its own cylinder. There are no replacement parts and the valve does not have to be taken apart for recharging and reassembling after filling. The valve is applicable to any size carbon dioxide extinguisher of the hand type. *C-O-Two Fire Equipment Co, Newark, N. J.*

Printer

REVOLUTE 8Q printer has been designed to meet the requirements of industries whose print production has graduated from the small to the intermediate stage. It occupies small floor space, will expose blueprints, direct process prints, and sepia negatives up to 54 in. wide. Speeds range from 6 in.



to 32 lin ft per min. It incorporates revolving contact and uses a quartz high pressure mercury vapor lamp, drawing approximately 75 watts per lin in. *Paragon-Revolute Corp, 77 South Ave, Rochester, 4, N. Y.*

Oil Resistant Floors

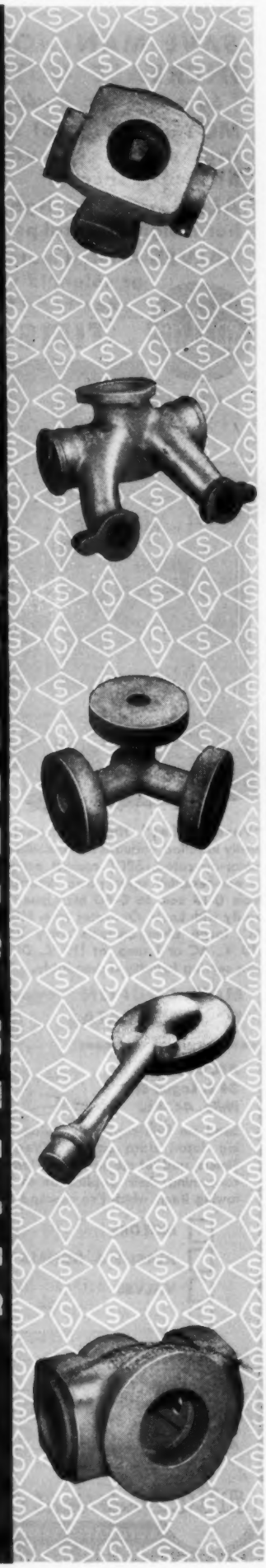
AWOG IS SAID to resist the penetration of acid, water, oil and grease. In addition to its imperviousness, the floor is said to present new attainments in durability and is smooth and dustless. It is recommended for new floors; for overlays on concrete, brick, stone or wood; for repairing and resurfacing areas of any size. *Flexrock Co, 2377 Manning St, Philadelphia, 3, Pa.*

Cleaning Machines

PRECISION CLEANING MACHINE was developed for cleaning parts in the electronic tube industry. The machine embodies the power of the larger industrial model and the over-all size of the heavy duty model with larger work

Checking a Sivyer Casting for dimensional accuracy.

SIVYER STEEL CASTINGS



IF YOU WANT GOOD FINISH . . .

IS WORTH LOOKING FOR

Lower cost for processing in your own plant is the direct result of good finishing of a Sivyer steel casting. But what, specifically, is good finishing? Sivyer understands it to comprise these points: (1) Careful inspection to eliminate castings without the necessary internal solidity and uniformity. We don't want your valuable machine and man-hours wasted by finding defects *after* part of your machining is done. (2) "Good looking castings." This covers a lot of qualities—clean, sharp corners where required, clean core holes, accuracy of dimension, freedom from distortion, removal of all waste metal. Sivyer Finishing Room men are trained to turn out castings whose appearance is as good as their internal integrity. Sivyer customers have learned that Sivyer finish means lower cost conversion. It's another of the reasons why the Sivyer (S) is worth looking for.

SIVYER STEEL CASTING COMPANY

MILWAUKEE (S) CHICAGO (S)

ARMY (E) NAVY

SAVE MAN-HOURS
INCREASE OUTPUT
by automatic timing of
MOTORS Control starting, stopping, running and sequence.
ALARMS Bells, lights or horns signal critical periods.
VALVES Actuate motorized or solenoid valves exactly on time.

atc **TIMERS**

"Vernier-Set" Timer, extremely accurate, easily installed, requires no lubrication. Telechron motor-operated, SPDT contact action, resetting or non-resetting upon power interruption. Dials from 0-15 sec. to 0-60 hrs., timed period set easily with knob. Operates from 110 or 220 V., AC; large silver contacts carry 25 amps. at 110 V., AC or 1 amp. at 110 V., DC. Thousands now serving industry dependably.

MAIL COUPON FOR FREE DATA

ATC Co., Inc.
34 E. Logan St.
Phila. 44, Pa.

P

Send me free copy of Catalog B10 giving detail data on your "Vernier-Set" Timers, and let me have more information concerning their application to the following items which I've checked (√).

☐ MOTORS
☐ ALARMS & SIGNALS
☐ VALVES
☐ .....

Name.....
Title.....
Firm.....
Address.....

atc *Industrial Controls*
AUTOMATIC TEMPERATURE CONTROL COMPANY, INC.
34 E. LOGAN STREET, PHILA. 44, PA.

baskets and a new surging centrifugal action. Variable action of the basket in solutions is provided. By snapping on the thermostatic switch, a surging centrifugal motion of the basket is produced with speeds varying from high to low. More effective agitation is said to follow with resulting higher percentage of acceptable clean parts. *L & R Mfg Co, 54 Clinton St, Newark, N. J.*

Plastic Hoods

PLASTIC HOODS for machine guards have been developed and are now made of Lumarith, transparent plastic sheet permitting full visibility but so light in weight that they can be lifted easily from its position for oiling, inspection or repairs to the machine. Hoods also capture oil which would normally spatter over the floor and walls near the equipment and return it for use over again. *Celanese Celluloid Corp, 180 Madison Ave, New York, N. Y.*

Vertical DC Motors

A NEW LINE OF DIRECT-CURRENT vertical motors ranging from 40 to 200 hp at 1750 rpm and in equivalent ratings at other speeds, has been announced by the company. New motors, furnished for both constant and adjustable speeds, are designed for low thrust, solid shaft applications on pumps, machine tools, etc. The motors are of dripproof, protected construction, providing complete

protection from dripping liquids and falling objects. Convenient fittings on both the upper and lower bearings simplify lubrication and the provision for the escape of excessive grease reduces the possibility of overlubrication. A special bearing housing prevents

Your Blueprint for
MORE POWER
starts with
OAKITE CLEANING

. . . Removing Sealing Compound from Potheads Easily

When you have this job to do, handle it the quick, effective Oakite way. You will find that a short immersion of potheads in tank containing boiling solution of Oakite Test X or other recommended material thoroughly softens and removes hardened sealing compound.

Whether for cleaning potheads, suspension insulators, house knobs, bolts, braces or other line hardware items, specialized Oakite materials are available that will expedite work and save you man-hours.

WARTIME SERVICE *FREE!*

The help of your nearby Oakite Technical Service Representative is freely available on ALL your cleaning work. Write today for further data on your particular cleaning problems.

OAKITE PRODUCTS, INC.
23 Thames Street, New York, N. Y.
Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE *Specialized cleaning*
Buy Bonds for Victory
MATERIALS & METHODS FOR EVERY CLEANING REQUIREMENT

Order Your Butler De-Scaler from these Dealers

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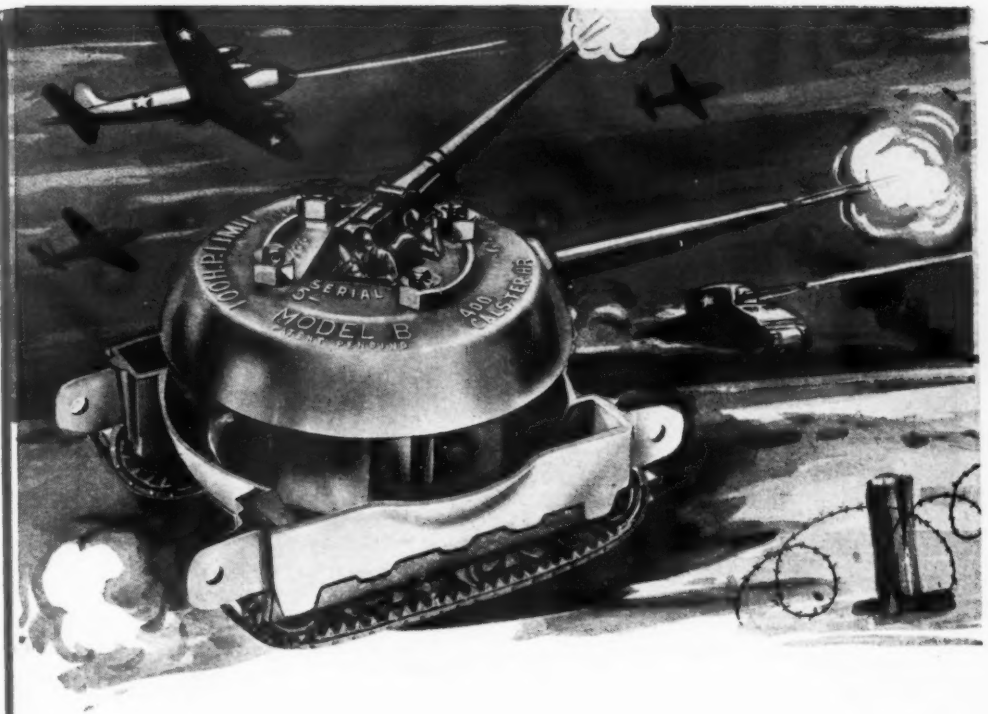
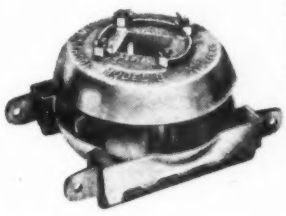
WEST VIRGINIA:
BLUEFIELD: Bluefield Supply Company
CLARKSBURG: West Virginia Mine Supply Co.
HUNTINGTON: Banks-Miller Supply Company.
WHEELING: Wheeling Machine Products Co.



Butler De-Scalers, Too Have Gone To War

Butler De-Scalers are now helping to pave the road to victory, however the War Production Board has made it possible for us to continue with sufficient manufacture to supply the needs of our customers.

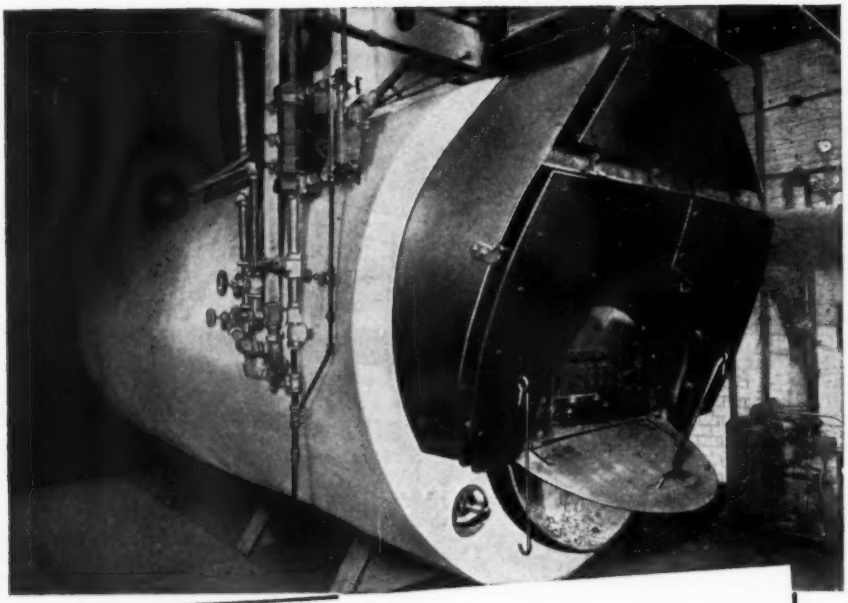
Butler De-Scalers are patented devices developed after years of patient and thorough experimentation, together with five years of actual service experience in thousands of steam plants throughout the country. It is the only proven electrolytic water correction device available to plant operators. You can absolutely depend upon Butler De-Scalers creating mineral-free, non-scale-forming water, and causing the removal of old scale. Butler De-Scalers stop all pitting and corrosion; increase the efficiency of your boiler equipment, with less fuel consumed; and maintain your boiler water at a proper Ph value. Be sure to get a GENUINE BUTLER DE-SCALER, from one of the listed authorized distributors. Write us for full information, or address the dealer nearest you.



REDUCES YOUR WATER CORRECTION BUDGET

BUTLER ENGINEERING COMPANY

P. O. Box 1699 **New Orleans, 11, La.**



125-hp. Scotch Marine Boiler in which steam pressure is maintained at 125 lbs. at a temperature of 350° F. Heat losses were substantially reduced by application of B-H *Black* Rock-Wool Blankets 2" thick and finished with ½" coat of B-H No. 1 Insulating Cement.

FOR INSULATING EFFICIENCY

AND LOW-COST APPLICATION

YOU CAN'T BEAT

B·H ROCK·WOOL BLANKETS

Baldwin-Hill Blankets are made by felting B-H *Black* Rock-Wool into large flat sheets between 4 different styles of metal fabrics. This B-H *Black* Rock-Wool is effective up to 1200° F. and is moisture-resistant. Standard blanket sizes of 2'x4' or 2'x8' make possible applications to large areas at minimal cost. Being flexible, they do not break in handling and easily conform to curved surfaces.

If a cement finish is desired, style 2A Blanket includes expanded metal lath making a good surface for keying the cement. This eliminates the necessity of applying a metal fabric to hold the cement as must be done in covering other types of insulation.

Send for catalog with full information and a generous sample of B-H Rock-Wool Blanket.

BALDWIN-HILL INSULATIONS

BALDWIN-HILL COMPANY

575 KLAGG AVE. • TRENTON, N. J.

NEW YORK • CHICAGO • KALAMAZOO

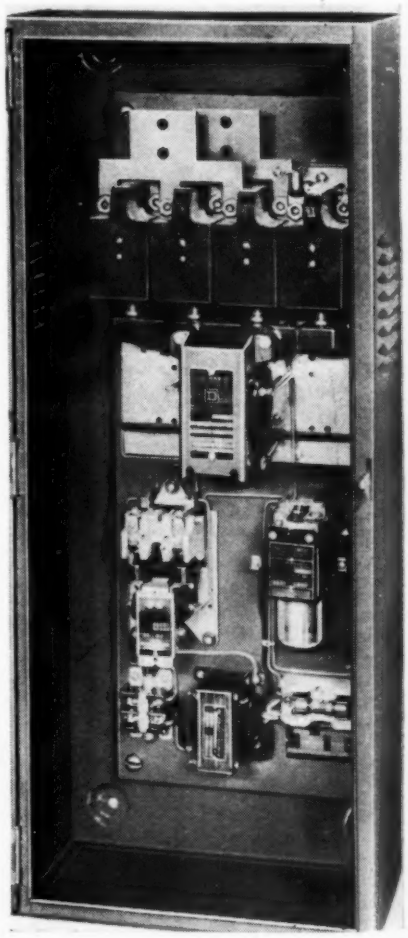
grease from entering the motor and damaging the commutator and the windings. *General Electric Co, Schenectady, N. Y.*

Liquid Refractory Coating

FEDERAL CROMOX is liquid refractory coating designed primarily for furnace walls in coal-, oil-, gas-fired and electric furnaces and in non-ferrous open-flame melting furnaces. It may be applied to firebricks, plastic firebrick, insulating firebrick and castable refractories. It becomes an integral part of the refractory to which it is applied. It is said not to crack, peel, blister or bloat, and it is also said to expand and contract with the furnace walls, preventing the development of cracks or fissures into which slag or flame can penetrate. Cromox withstands temperatures up to 3000 F and is said to resist flame abrasion and erosion, slagging, spalling, and attacks by acids, alkalies, moisture and steam. *Federal Refractories Corp, Akron, Ohio.*

Safety Panel

SAFETY PANEL CLAIMS to eliminate the hazard created by high open circuit voltages of transformer type ac arc



THEY'RE THE NUTS FOR POSTWAR PLANNING

IT'S true that now we can't supply all the Elastic Stop Nuts Uncle Sam wants – even with three big plants running 24 hours a day.

It's true that Elastic Stop Nuts are flying in every American plane – sometimes 50,000 of them in a single ship.

It's true they're on tanks, guns, naval vessels and production equipment–more than all other lock nuts combined.

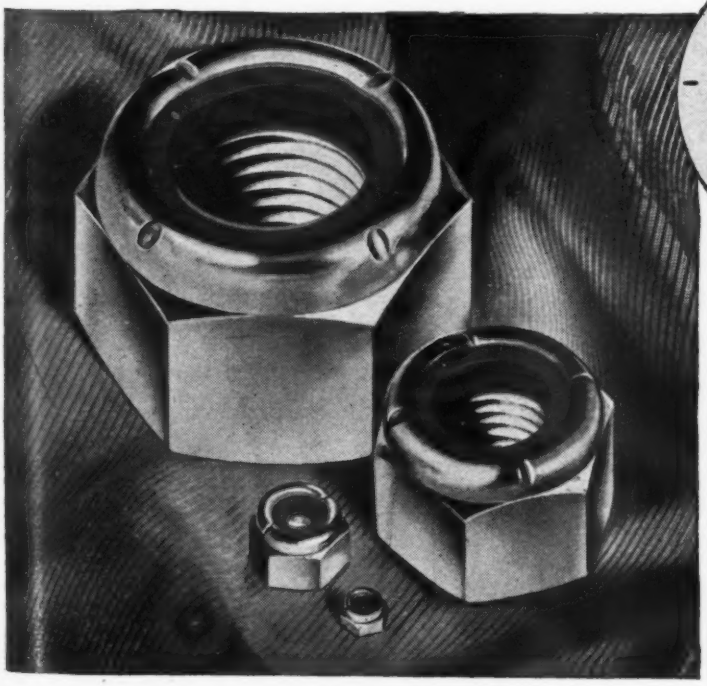
This is because these nuts stay put. There's a red elastic locking ring in the top which grips the bolt with an oil- and water-proof seal and eliminates all axial play and wobbling.

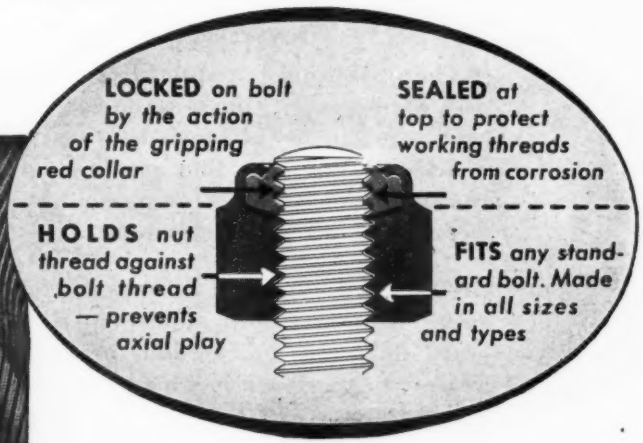
When the war's won, the millions of Elastic Stop Nuts we're pouring out each day can be turned to the fastening problems of peace.

They can be turned to producing better products and equipment that will save time and expense for maintenance engineers.

Whatever your fastening problems might be, our engineers, experienced in the work of both war and peace, will be glad to help cope with them.

Feel free to call upon them. They'll work with you and suggest the proper Elastic Stop Nut to lick the job.




LOCKED on bolt by the action of the gripping red collar
SEALED at top to protect working threads from corrosion
HOLDS nut thread against bolt thread — prevents axial play
FITS any standard bolt. Made in all sizes and types

ELASTIC STOP NUTS

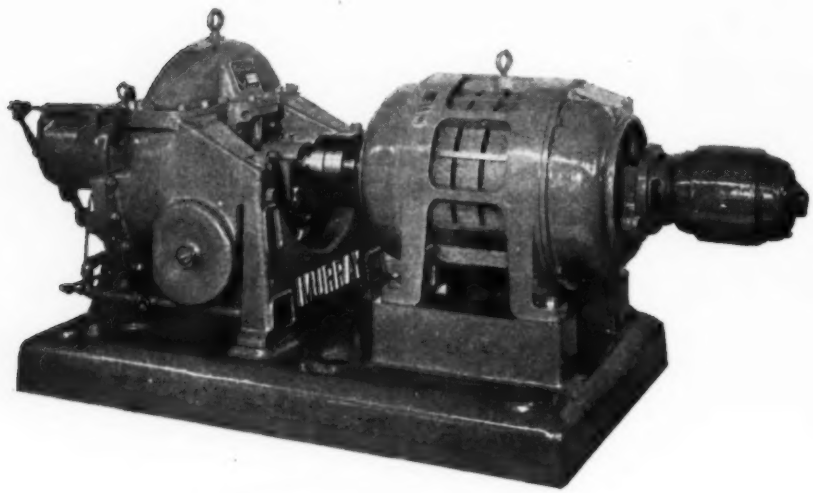
Lock fast to make things last

ESNA TRADE MARK

ELASTIC STOP NUT CORPORATION OF AMERICA
Union, New Jersey and Lincoln, Nebraska

MURRAY TYPE "U"
Mechanical Drive Turbines

• Murray Type "U" Mechanical Drive Turbines are adaptable to a variety of drives. View shows Type "U" turbine directly connected to a 20 K. S. alternating current generator operating at 1800 r.p.m. The unit is installed in a large oil refinery in Venezuela where the turbine supplies exhaust steam for process requirements.



• There is much required of producers for Victory these days as more and more war equipment is needed. Back of the machines and men that produce must be ample power facilities for power has always been the basis of production.

MURRAY Equipment is meeting all tests today as wheels spin and twenty-four-hour work days prevail. Design, backed by 70 years of experience has made this possible.

BOILERS . . . . . TURBO GENERATORS
MECHANICAL DRIVE TURBINES
ENGINES . . . UNIT HEATERS . . . GEARS

BOILERS TURBINES ENGINES

MURRAY
IRON WORKS COMPANY
INCORPORATED 1870
BURLINGTON IOWA

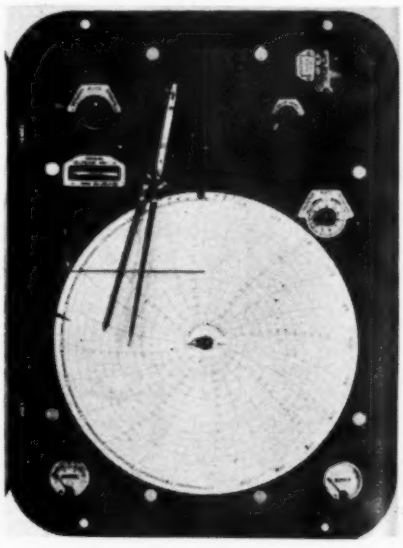
welders. It is known that physical contact from electrode to grounded metal services when not welding can sometimes result in operator injuries. New panels eliminate this hazard by automatically disconnecting the welded transformer after the arc is broken. The transformer is automatically reconnected the instant the operator touches the electrode to the work. Thus the arc is struck with no delay and no loss in operating speed or efficiency. These new safety panels can be used with any make or model of ac transformer-type arc welder. *Square D Co, Industrial Controller Division, Milwaukee, Wis.*

Sump Type Liquid Filter

INSTALLATION OF this filter is said to protect the pump from abrasive particles which cause rapid wear and at the same time provide clean liquid at various points of usage. It is said to prevent the build-up of sludge, etc in a hydraulic system, thus permitting less frequent inspection and clean-out. The unit consists of four major parts: an upper end plate mounting a third clean-out lift connection and a perforated metal central supporting tube on which is mounted the filter insert; a heavy corrugated metal screen to supply strength and rigidity, over which lies the preformed filter insert; and a lower end plate. A wing nut holds the entire assembly together. *Stay-New Filter Corp, 11 Center Park, Rochester, N. Y.*

Air-Operated Controller

AIR-OPERATED AUTOMATIC control instrument, known as convertible free-vane controller, is made for auto-



ROUND-THE-CLOCK SERVICE ASSURED...

...by U.S. in power plant's turbine!

"HOURS OF OPERATION" alone does not determine the quality of a turbine oil. More important are the characteristics of the oil during a given period. Did the oil need purification? Was make-up oil kept to the minimum? Did the system and the oil show rust? These are the sort of things that determine whether your turbine is operating economically, trouble-free.

One of the many outstanding performance records of Shell Turbo Oil is indicated in the analyses shown at the right. Note how little change took place even after 24,483 hours of continuous operation. Here is definite proof that Shell Turbo Oil has superior oxidation stability. It also prevents rust. Can the turbine oil you now use match this? Draw off a sample and see.

For details on this and other outstanding performances of Shell Turbo Oil see the Shell man. Or, write Shell Oil Company, Inc., Dept. "E," 50 W. 50th St., New York, N.Y., or 100 Bush St., San Francisco, Cal.

SHELL TURBO OIL

Currently, the U.S. Navy has first call on Shell's entire production of marine turbine oil

CERTIFIED PROOF OF THE SUPERIOR

*OXIDATION STABILITY

OF SHELL TURBO OIL

CHARACTERISTICS		
156	*Viscosity @ 100° F.*	159
Clear	*Appearance*	Clear
.05	*Neutralization No.*	.05
.1	*Saponification No.*	.3

Performance record of Shell Turbo Oil in a 6,000 kw. unit of a large utility company in the Southwest.

There's an

R-S DISTRIBUTOR

As Near as Your

Telephone

Above: 15-lb Wafer Type (Narrow face-to-face construction). *Below:* 125-lb valve equipped with control cylinder. Double end stuffing box eliminates end thrust.

These R-S Distributors are valve specialists. They are experienced with the solution of problems encountered in the control and shut-off of air, gas, steam, liquids and semi-solids. Familiar as they are with the application of valves to high and low pressures, temperatures and volumes, they can frequently make suggestions that will simplify a valve installation and reduce costs.

Naturally, these local representatives are throughly familiar with the R-S development of special metals for resistance against heat, abrasion and corrosion.

Get acquainted. These valve experts are good men to know well.

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R-S
QUALITY PRODUCTS SINCE 1908

15 to 900 psi

VALVE DIVISION
R-S PRODUCTS CORPORATION
4536 Germantown Avenue • Philadelphia 44, Pa.

R-S Streamlined BUTTERFLY VALVES

matically controlling temperature (up to 3600 F) flow, liquid level, pressure, draft humidity, pH value, and time program. This controller operates on the same basic free-vane principle as that used in previous models offered by the company. The adjustments for fitting the controller to the requirements of the process are located on a dial board above the chart. *The Bristol Co, Waterbury, Conn.*

Non-Metallic Grilles

NON-METALLIC GRILLES are furnished as standard in a flameproof, fire resistant prime coat finish. Because of the wide spacing of the bars, the final coat can be easily and quickly applied. Design V60 and V50 non-metallic grilles offer the utmost in flexibility, according to the manufacturer; the bars rotate through an arc of 90 deg and are individually adjustable. *Tuttle & Bailey, Inc, New Britain, Conn.*

Insulating Cement

BALDWIN-HILL No. 1 non-corrosive insulating cement contains a special rust inhibitor which prevents corrosive action, even if air-dried over a long period. The cement is made from high-temperature resisting B-H black rock-wool and is effective, according to the company, up to 1800 F. *Baldwin-Hill Co, 575 Klagg Ave, Trenton, N. J.*

Portable Dust Collecter

BARGAR SAFE-AIRE can be used to either supplement larger, permanent dust-control systems or to serve in place of such systems when necessary. Its basic use is to collect dust from a single dust-making machine, separate the dust from the air, and blow the clean air directly back into the shop. The unit has a capacity of 600 cfm and the company states that one of its most important advantages is that it does not exhaust any air from the shop, but returns it approximately 97% clean and slightly warmer than before. The unit is powered by a ⅛ hp motor running a blower at 3400 rpm. *Bargar Sheet Metal Co, 12401 Euclid Ave, Cleveland, Ohio.*

Close Clearance Pump

CLOSE CLEARANCE PUMP is manufactured to answer specific requirements for the refining industry. Some of its features include bronze bushed valve gears and piston valve. The fluid end is designed for 400 psi suction pressure

WAR

TESTS A LOT OF THINGS *including Steam Boilers!*

Modern war is a hard taskmaster — men and machines on the production front must set and meet a terrific pace — survive severe endurance tests of their own to "deliver the goods" to the fighting fronts.

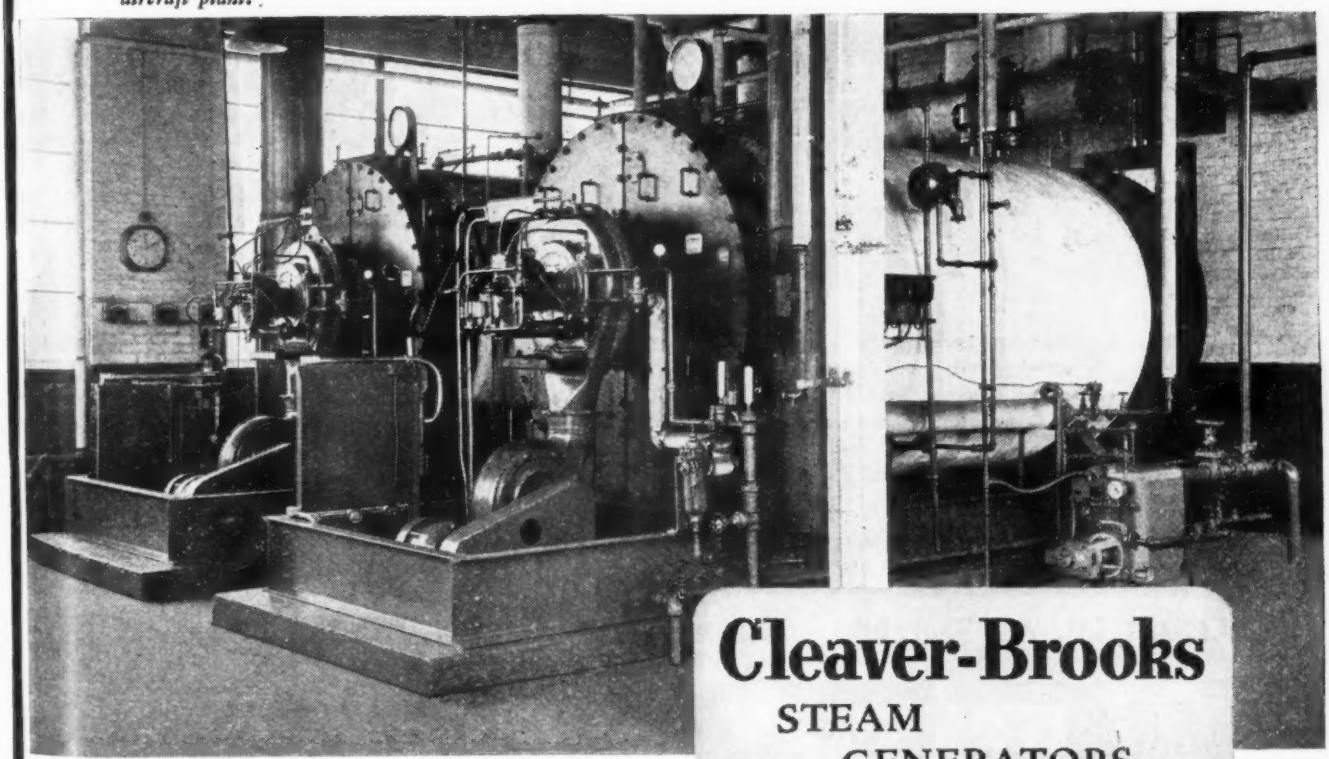
Cleaver-Brooks steam generators have been put to test in scores of essential war industries, and at advance naval and army base locations where unfailing dependability is vital and "mechanical trouble headaches are out". In remote regions on the very edge of America's military ring of protection Cleaver-Brooks Steam Generators are delivering the dependable service for which they were chosen.

Quick steaming capacity — high thermal efficiency (not less than 80% guaranteed) — their minimum manpower requirements in operation and maintenance — their simple, low-cost installation — their dependable 'round-the-clock performance — these are but a few of their many advantages that have given them a definite "edge" wherever low-cost steam is needed.

Get full information now—for the future—on Cleaver-Brooks oil-fired steam generators — sizes 20 to 500 H.P.; pressures 15 to 200 lbs.

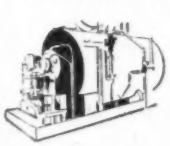
CLEAVER-BROOKS COMPANY
5109 NORTH 33RD ST. MILWAUKEE, U. S. A.

Two 250 H.P. Cleaver-Brooks Steam Generators as installed at an Eastern aircraft plant.



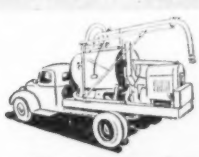
Cleaver-Brooks
STEAM GENERATORS

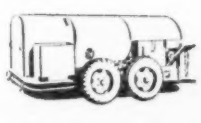
CLEAVER-BROOKS PRODUCTS INCLUDE:

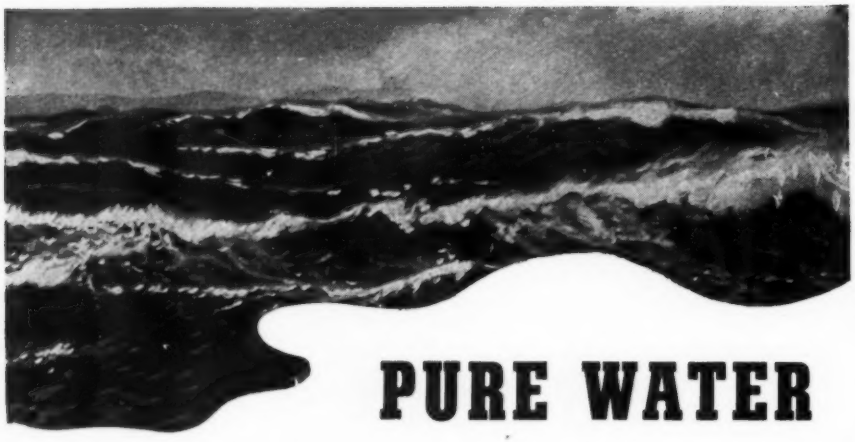

Steam Generators

Food Dehydrators

Tank Car Heaters


Bituminous Boosters

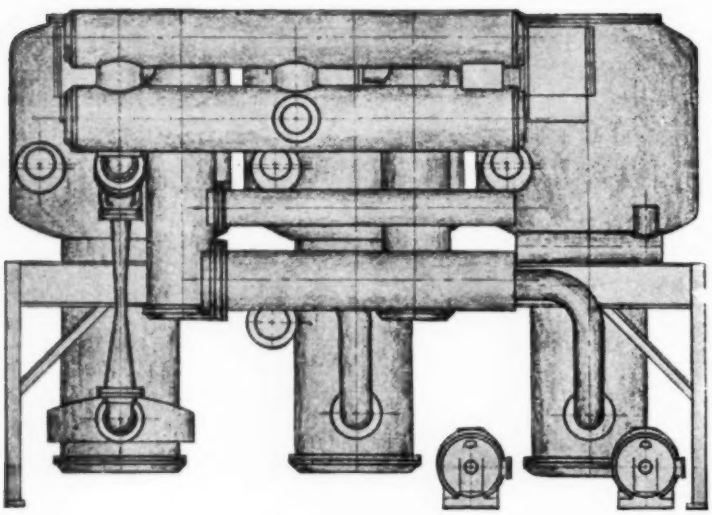

Special Military Equipment



PURE WATER

Certain industrial processes require the use of large quantities of pure water. Boiler Plants need it for peak efficiency. For human consumption pure water is vitally important—to the folks on the home front as well as to the men on the fighting fronts.

While water is universally present, the available supply often contains certain objectionable salts and bacteria that make it unfit for immediate use.



The Henszey Distillation System is the modern method of assuring a plentiful supply of absolutely pure water—water that is free from objectionable salts and harmful bacteria. The Henszey unit gives six effect efficiency with only three evaporator effects. Pure water is made available with a saving of half the fuel necessary to get the same results by means of conventional distillation equipment.

If a supply of pure drinking water is your responsibility, if you need pure water in your plant or for your manufacturing processes—plan ahead now—investigate the Henszey Distillation System.

HENSZEY CO. Dept. D8 Watertown, Wis.

HENSZEY

CONTINUOUS BLOWDOWN SYSTEMS

Boiler Feed Regulators • Proportioning Valves
Feed Water Meters • Flow Indicators • Heat Exchangers

and 600 psi discharge pressure. The steam end has been designed for 250 psi while a bypass arrangement permits low throttling. *Leyman Mfg Corp, McGowan Pump Div, 45 Central Ave, Cincinnati, Ohio.*

Electric Motors

A NEW LINE OF TOTALLY INCLOSED motors has been added to group of Tri-Clad units. These are available in both polyphase, 60-cycle induction type and single-phase, 60-cycle, capacitor type. New motors have all the important basic features of Tri-Clad group,

including protection against physical damage, electrical breakdown and normal operating wear and tear. In addition, all parts of the motor inclosures—frame, end shields, and conduit boxes—are cast iron, offering resistance to rust, corrosion, accidental blows, and rough handling. *General Electric Co, Schenectady, N. Y.*

Portable Oil Filter

UNIT CONSISTS OF a standard Hilco Hyflow oil filter and a small gasoline engine driving a rotary pump for forcing the oil through the filter. Exhaust gas is passed through a jacket around the filter for heating the filter unit. When operating, the unit is simply wheeled up to the equipment containing the oil, which is piped to the filter inlet, purified and returned to the equipment, or this same work can be accomplished by installing a dirty oil and clean oil tank. *The Hilliard Corp, 342 West Fourth St, Elmira, N. Y.*

Relief Valve

SELF-STABILIZING relief valve design is such that variations in pump speeds cause no fluctuations in gage pressure, which remains constant under all conditions, preventing wear and chatter. Without change of spring, working pressures may vary from 0 to 3000 psi.

STEEL TUBES THAT MEET THE EXTRA *Demands* OF WARTIME SERVICE

THE *extra* margin of safety and strength so vital to modern high-temperature, high-pressure service is adequately provided in Globe Boiler and Pressure Tubes. Under the severe conditions of wartime service, Globe Tubes are proving the value of extra precautions taken in their manufacture.

In war production industries, power plants...in fighting, transport and merchant ships...in locomotives and other power units... Globe Boiler and Pressure Tubes are meeting extra demands of service.

Globe mechanical tubing serves many critical needs in aircraft construction. Globe engineers can help you to select tubes with the exact characteristics you require—feel free to consult them. Their service is yours for the asking.

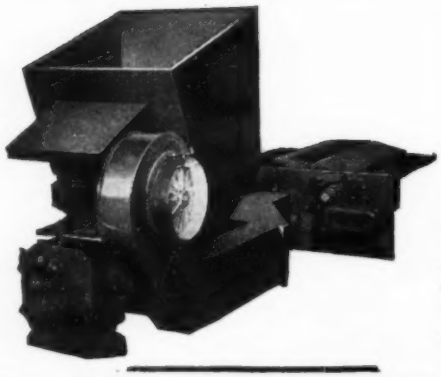
GLOBE TUBES

★ STAINLESS TUBES
★ BOILER TUBES
★ GLOBEIRON TUBING
★ GLOWELD TUBES
★ CONDENSER AND HEAT EXCHANGER TUBES
★ MECHANICAL TUBING

GLOBE STEEL *Tubes*

GLOBE STEEL TUBES CO., *Milwaukee, Wisconsin, U.S.A.*

New DEVELOPMENTS BY FREDERICK ADD NEW THRIFT and CONVENIENCE TO INDUSTRIAL STOKER OPERATION



● **FULL ACTIVE GRATE SURFACE . . .** that's one new Frederick advantage! There's more grate area; no dead plates—whether furnished with or without side dumping grates.

● **IMPROVED TUYERES** are designed with air ports so arranged and proportioned as to insure thorough air distribution and maximum combustion efficiency.

● **TUYERES ARE LOCKED IN PLACE** so they cannot be raked up inadvertently.

● **COMPLETELY ENCLOSED WINDBOX** simplifies and makes a neater installation; eliminates danger of efficiency loss through leaky brickwork.

● **TWO CLEAN-OUT DOORS** give easy access to *both* sides of the undergrate area to facilitate cleaning.

. . . All these features, and many more, are Frederick innovations engineered to give you more for your stoker dollar than has been available ever before. A complete description of these features is in our new Stoker Bulletin. Ask for your free copy. You'll find it's interesting reading.

FREDERICK STOKERS

The FREDERICK IRON & STEEL CO.

Frederick, Maryland

COMPLETE LINE OF CENTRIFUGAL PUMPS FOR ALL PURPOSES
STEAM OPERATED ASH CONVEYING SYSTEMS - ASH STORAGE BINS

Sound an Alarm!

with this new, positive

FLOW RATE INDICATOR

Actual photograph showing sturdiness and compactness of the Rota-Sight Alarm.

Do you have valuable or critical equipment that can be ruined by failure of a cooling or lubricating flow? Can an excessive flow rate at some point in your process spoil your finished product? If so, the Rota-Sight Flow Rate Alarm may give just the flow rate protection you are seeking.

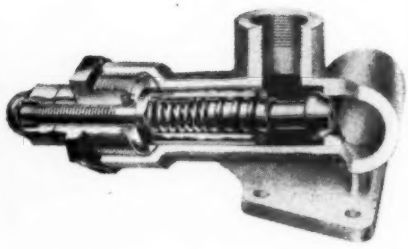
This indicator operates through a float which moves up and down a pyrex tube into which triangular flutes have been fashioned. As the float rises, the area within the flutes increases, causing the float to assume a position in the tube in direct proportion to the flow rate. A magnetic extension on the float trips an external switch to operate the alarm circuit. The alarm flow point is adjustable over the entire flow range and operates accurately at the set position.

The Rota-Sight Alarm is used for flows of water, lubricating oils, filter feeds, overflows, chemical additives, etc. It is built in sizes up to 2½" and may be obtained in any corrosion-resistant metal that can be cast. It is easily installed in either horizontal or vertical lines.

Write for Catalog 92-A.

FISCHER & PORTER CO.

608 COUNTY LINE ROAD, HATBORO, PA.



and seat pressure be maintained at as low as 10 psi, allowing use of materials such as plastics in the piston. Backpressure, provided by return flow, has no effect on pressure gage, but equalizes pressure of seat and insures positive control in critical lines. Valve is furnished for use with all standard tubing sizes and for internal or external pipe threads or flanged ends. *Merit Engineering Inc, 40 Clifford St, Providence, R. I.*

Cable Connector

A CABLE CONNECTOR that locks tight, quickly unlocks and is fully insulated has been announced for arc welding. Female section is soldered to the cable lead, and the male section is soldered to cable extension. Removable insulators are securely held in position with Allen screws while connection is made by inserting male section into female section. Thus, with a twist, the locking spring rides the cam into position holding both sections tight, to unlock, simply twist apart. *Jackson Products, 3265 Wight St, Detroit, 7, Mich.*

Industrial Thermometer

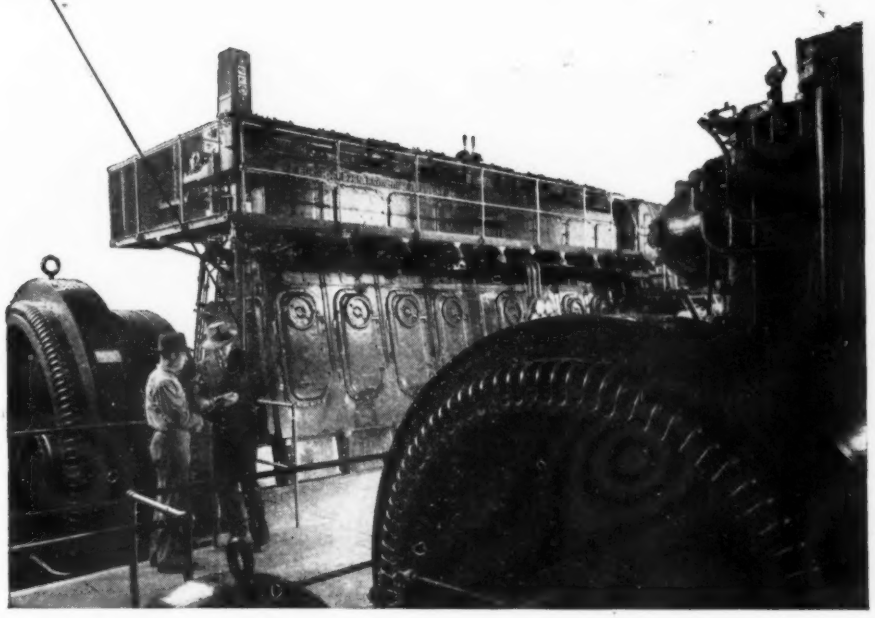
COMPANY IS INTRODUCING a one-piece industrial thermometer case, which is shallower, making it possible to see the mercury column through a wider angle of vision. The chromium-plated bezel fits snugly into the grooved case in such a way as to hold the thick glass front securely against four wavy tension springs. This construction results in a dustproof, rattleproof and practically fumeproof thermometer, according to the maker. New instruments will be equipped with easy-reading Binoc tubing. *Taylor Instrument Companies, Rochester, 1, N. Y.*

Fiber Pipe

ORANGEBURG fiber pipe is formed on special machines to develop a homogeneous structure (not laminated) of fibers oriented in three planes, so that the structure of the pipe is uniform throughout. After forming and drying the pipe is subjected to high vacuum and then thoroughly impregnated with

Treat your Diesels

as though they could never be replaced—



— lubricate with Gulf Parvis Oil

Gulf Parvis Oil provides better lubrication under today's peak-load and over-load operating conditions

YOUR Diesels are precision-built for long dependable service under normal operating conditions. But long periods of peak-load and over-load operation to meet heavy wartime demands for power have greatly multiplied the problem of avoiding excessive wear and shortened useful life.

Today better lubrication care is a vital necessity to head off trouble! Now, more than ever, it pays to use lubricating oils that provide an extra margin of protection to Diesel cylinders, pistons, bearings and other currently hard-to-obtain parts.

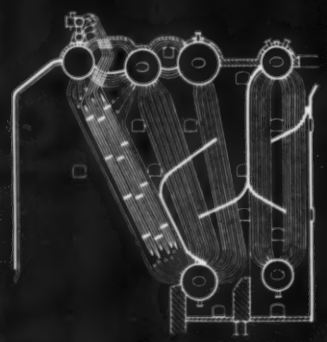
You insure this added protection when you put Gulf Parvis Oil in service to lubricate your Diesels. For built into this quality oil are greater stability and endurance—it stands up and provides a tough film of highest lubricating value under severe operating conditions—conditions which often cause excessive wear, below standard Diesel performance, and high maintenance expense.

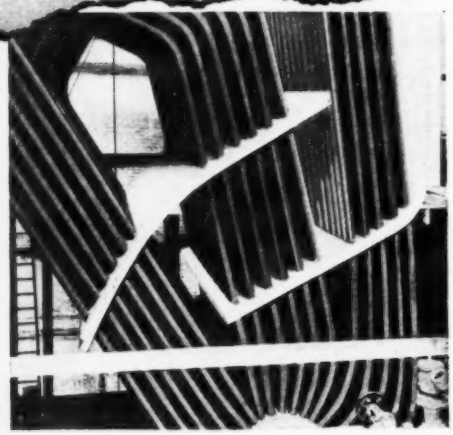
Gulf Parvis Oil is quickly available to you through 1200 warehouses located in 30 states from Maine to New Mexico. Write or 'phone your nearest Gulf office today.

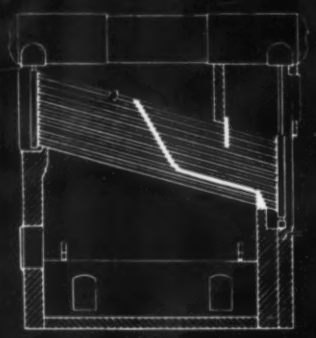
GULF INDUSTRIAL LUBRICATION

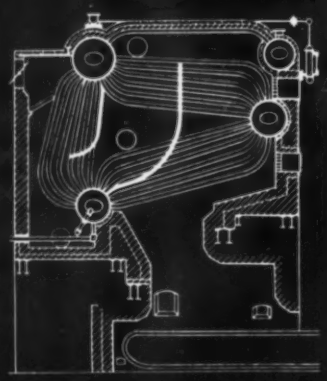
GULF OIL CORPORATION
GULF REFINING COMPANY
GULF BUILDING · PITTSBURGH, PA.

GET MORE STEAM
by Streamlining









Streamline the cross-flow of gases over your boiler's heating surfaces and you increase steam output. It's as simple as that with Enco Baffles installed in your boilers.

Scientifically tapered gas passes and curved baffle surfaces put every square foot of heating surface to work, maintain efficient gas velocity, eliminate bottlenecks, eddy currents, dead gas pockets.

Draft losses reduced. Less steam needed for cleaning, because soot blowers work more effectively—and need be used less often with Enco Baffles.

Applicable to any design of water-tube boiler, fired with any type of fuel. Every installation individually designed on the basis of 25 years' experience in this highly specialized branch of engineering. Installed by skilled mechanics, using selected materials.

Write for BULLETIN BW40

FREE

Gives important data on modern baffle construction

THE ENGINEER COMPANY

75 WEST STREET • NEW YORK 6, N. Y.

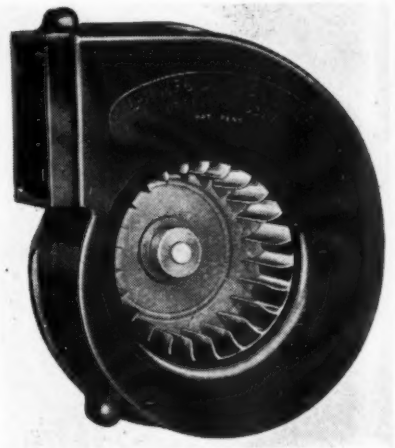
Enco Streamline Baffles

PRODUCED EXCLUSIVELY BY THE ENGINEER COMPANY

coal tar pitch. Finished pipe, by weight, is 25% fiber and 75% pitch. The chemical properties are similar to coal tar pitch and it is said to be resistant to most dilute inorganic acids, alkalies, and salts as found in industrial wastes, cinder fill and corrosive soil conditions. *The Fibre Conduit Co, 292 Madison Ave, New York, N. Y.*

Blower

HOUSING of this blower is made of one piece high impact plastic, capable of withstanding 110 C. The turbo type wheel is 3 in. in diameter where zinc plated, ¼ or $\frac{5}{16}$ in. shaft bore. *L-R Mfg Co, Blower Division, Torrington, Conn.*



Strain Connector

CABLE STRAIN CONNECTOR meets the need for this type of equipment where multiple cables are being substituted for copper tubing or rolled sections in an effort to conserve copper. Illustration shows type SUD strain connector to take two 1,000,000 CM cables in parallel. Fittings are available for multiples of two or four cables in all cable sizes up to 1,000,000 CM. *Delta-Star Electric Co, Chicago, Ill.*

Small Capacity Oil Reclaimer

SMALL-CAPACITY lubricating oil reclaimer can handle, in addition to reclaiming lubricating oils of the motor fleet, a limited quantity of waste lubricating oils drained from equipment in the plant. With a capacity for purifying eight gallons of dirty oil in 70 to

Let this be your contribution to Victory: Make your heating equipment serve longer by good care . . . Conserve fuel by promptly replacing worn-out or inoperative parts.

7-Point Check-up for UNIT HEATERS

Don't wait until something goes wrong. Preventive maintenance pays big dividends in the operation of Unit Heaters, especially today when damaged parts are difficult to replace and every breakdown imperils the success of the war production effort.

Here is a seven-point maintenance check-up designed to help you get best results from your Unit Heaters . . .

(1) Blow dust and dirt from heating coil, preferably with air hose.

(2) Make sure that fan and casing are free of dirt or grease.

(3) Lubricate motor regularly according to manufacturer's recommendations, using best quality lubricants. Keep motor clean.

(4) Tighten motor and support bolts.

(5) Adjust discharge deflectors for best heating results.

(6) Check wiring and electrical connection to thermostatic control, making sure thermostat is clean.

(7) Check the operation of float and thermostatic drip trap, clean thoroughly, replace any parts that are inoperative—float, seat or thermostatic air vent.

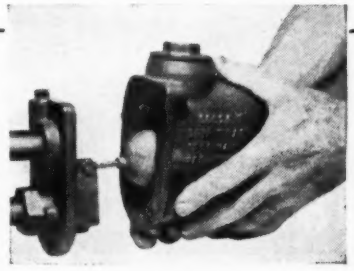
Your nearest Webster Representative will help you to eliminate waterlogging or air binding of Unit Heaters. Often a Webster Float and Thermostatic Drip Trap is all you need to secure vastly improved heating results.

WARREN WEBSTER & COMPANY, Camden, New Jersey
Pioneers of the Vacuum System of Steam Heating : : Established 1888
Representatives in principal cities : : Darling Brothers, Limited, Montreal, Canada
National Distributors for Webster-Nesbitt Unit Heaters

ARMY E NAVY

Webster Steam Heating

Webster Float and Thermostatic Drip Traps are made for the pressure and capacity conditions encountered with all Unit Heaters. Continuous draining and remarkable overload capacity are assured by the float-controlled *outward opening valve*. The full-sized thermostatic bypass insures continuous discharge of all air and non-condensible gases.



BRONZE BEARING BARS

AND TWO CAPABLE SUBSTITUTES

Magnolia Isotropic Bronze Bars are die-cast by an exclusive crystal control method which produces a more homogeneous structure than that of ordinary bronze bearing bars. Bearing surfaces are uniform and free of blow holes, cracks and spongy material. Magnolia Bronze wears longer than any sand cast bronze.

For those who cannot obtain priorities high enough for bronze, two capable substitutes have been developed: Defender, a tough, malleable and easily machined babbitt, and Commando, a bearing iron with manganese, copper and graphite evenly dispersed throughout the grain structure.

PHYSICAL CHARACTERISTICS

BEARING METAL	ULTIMATE STRENGTH lb per sq. in.	YIELD POINT lb. per sq. in.	ELONGATION in 2 in.	BRINELL HARDNESS
BRONZE	31,250	26,000	8.5%	70
DEFENDER	16,000	7,685	15%	19.5
COMMANDO	54,000	36,400	11%	115-120

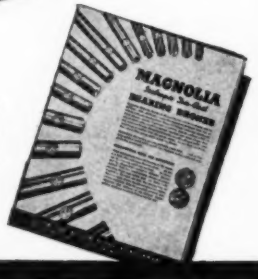
MAGNOLIA BRONZES are available in over 700 stock sizes, which include both cored and solid bars. Stock length is 13"; outside diameters range from 1" to 9". Thin walled bars and simple shoulder or flanged bushings roughed to dimensions are also available.

DEFENDER BARS are recommended for high speed, light loads, where it is desired to machine a bushing rather than pour babbitt. Not recommended for very thin sections. Solid and cored bars are available in sizes from 1" to 5" outside diameter.

COMMANDO BARS are recommended for extra heavy pressures and shock loads, also excellent for high speeds in conjunction with hardened shafts. Stock bars, both solid and cored, are available in rough sizes only from 1" to 6" outside diameter.

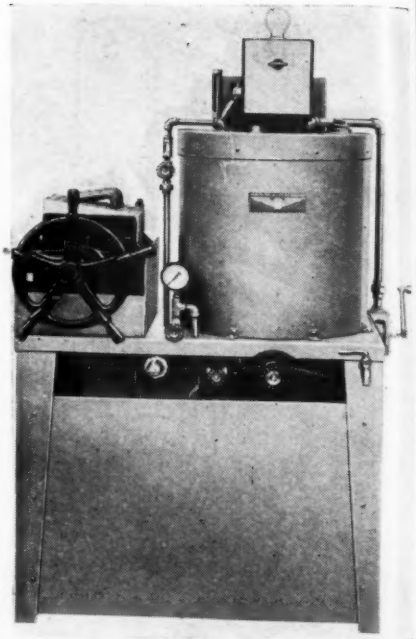
NEW LEAFLET

Write for copy of descriptive leaflet on Magnolia Bearing Bronze. Includes table of over 700 stock sizes available.



MAGNOLIA METAL CO. • ELIZABETH, N. J.

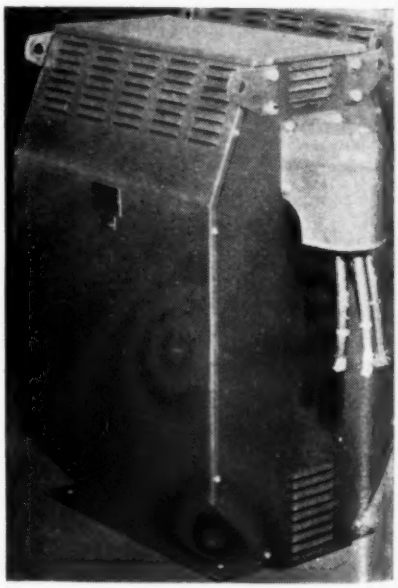
MAGNOLIA BEARING METALS



90 minutes, this model will handle 2500 gallons of waste lubricating oil per year when operated once per day. The machine has 2-stage filter press, is semi-automatic, operating under thermostatic control, and utilizes common refinery earths. *Youngstown Miller Co, Sandusky, Ohio.*

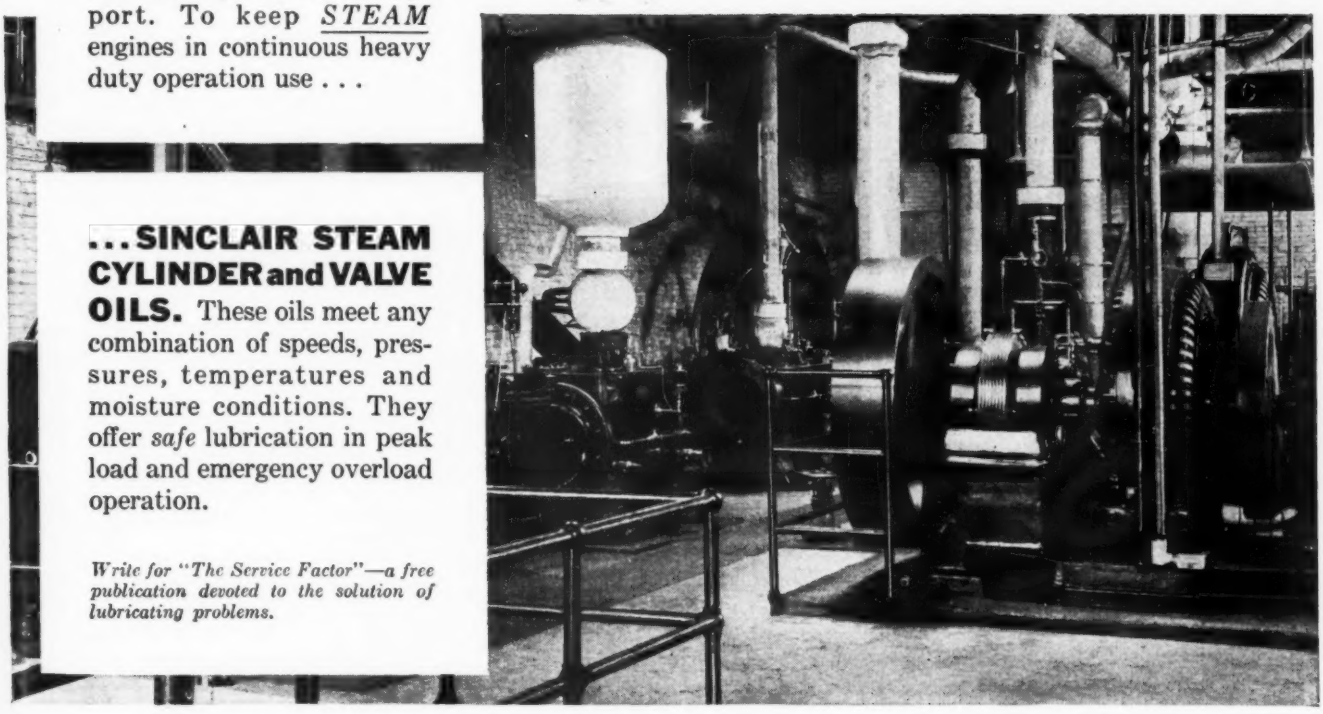
Dry-Type Transformers

DRY-TYPE NATURAL-DRAFT transformers for industrial use on 600 volts and below. New transformer has a two-legged core with high-voltage and low-voltage coil on each leg. The core is clamped at its top and bottom with the bottom clamps also serving as mounting feet. Coils are exposed for maximum cooling with a large portion of their copper outside the core. Use of two small coils instead of one large one has permitted them to be designed



Official U. S. Navy Photograph

OVERSEAS ATTACK demands powerhouse support. To keep *STEAM* engines in continuous heavy duty operation use . . .

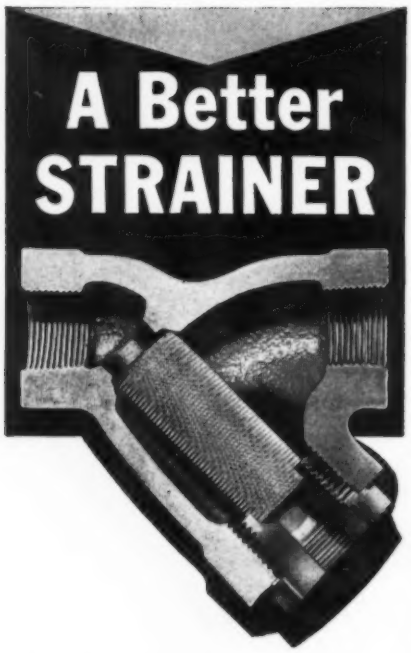


. . . SINCLAIR STEAM CYLINDER and VALVE OILS. These oils meet any combination of speeds, pressures, temperatures and moisture conditions. They offer *safe* lubrication in peak load and emergency overload operation.

Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.

SINCLAIR INDUSTRIAL OILS

FOR *FULL INFORMATION OR LUBRICATION COUNSEL WRITE* SINCLAIR REFINING COMPANY (INC.), 630 FIFTH AVENUE, NEW YORK CITY



- Cadmium Plated Inside and Out
- High-Grade Woven Monel Wire Screen
- Readily Removed Steel Blow-Off Bushing
- Screen and Bushing Come Out Together—Go Back Together, Automatically Aligning
- For Steam Lines or Water, Oil and Other Fluids
- Reasonably Priced
- 6 Sizes from ½" to 2" for Pressures up to 600 lbs
- Many Thousands in Service
- Sold by Over 100 Mill Supply Houses

See Your Supply House or Send for Bulletin S-200

YARNALL-WARING COMPANY
100 Mermaid Ave. PHILADELPHIA 18, PA.

YARWAY STRAINERS

with more turns of smaller wire for the same copper loss, resulting in lower exciting current and lower inrush currents when the primary of the transformer is energized. *General Electric Co, Schenectady, N. Y.*

Test Pliers

TRANSPARENT PLASTIC HANDLES and jaws of a new insulated fuse puller house a test circuit which can be used to detect blown fuses or presence of voltage (up to 250) in outlets or along circuits. A 10-watt carbon lamp in one handle gives indications that can be seen in any direction. *Star Fuse Co, 235 Canal St, New York, N. Y.*

Photoelectric Relay

GENERAL-PURPOSE photoelectric relay for outdoor use is designated as Type CR7505-K108, and it is for applications requiring rapid and accurate counting, controlling, sorting, or limiting operations. Relay can be mounted in any position and can be adjusted under actual operating conditions without removing the cover. *General Electric Co, Schenectady, N. Y.*

Power Lines

(*Continued from page* 130)

head of the Purdue School of Mechanical Engineering, died June 27, at the age of 71. Both men had been identified with the development of Purdue to a large university.

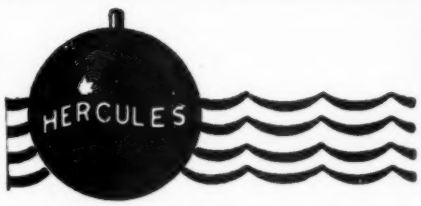
Carl King general superintendent of the **Wickwire-Spencer Steel Co,** died at Palmer, Mass., at the age of 63, June 26.

Depending upon viscosity and other conditions, the De Laval-IMO Oil Pump can either be coupled directly to the shaft of a steam turbine or through a speed reducing gear, as here shown. This unit is designed for continuous service, the turbine having its own "lube" oil pump, oil cooler, filter, and rate-of-flow indicator, and being protected by a mechanical governor and a pressure release valve. The main pump has only 3 moving parts, and no valves, gears or cams. It is perfectly balanced, both hydraulically and rotationally and the discharge is free from pulsation.

Ask for Publication I-109.

IMO PUMP DIVISION
of the De Laval Steam Turbine Company
Trenton, New Jersey

HERCULES
Seamless Copper
FLOATS



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Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

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HERCULES FLOAT WORKS
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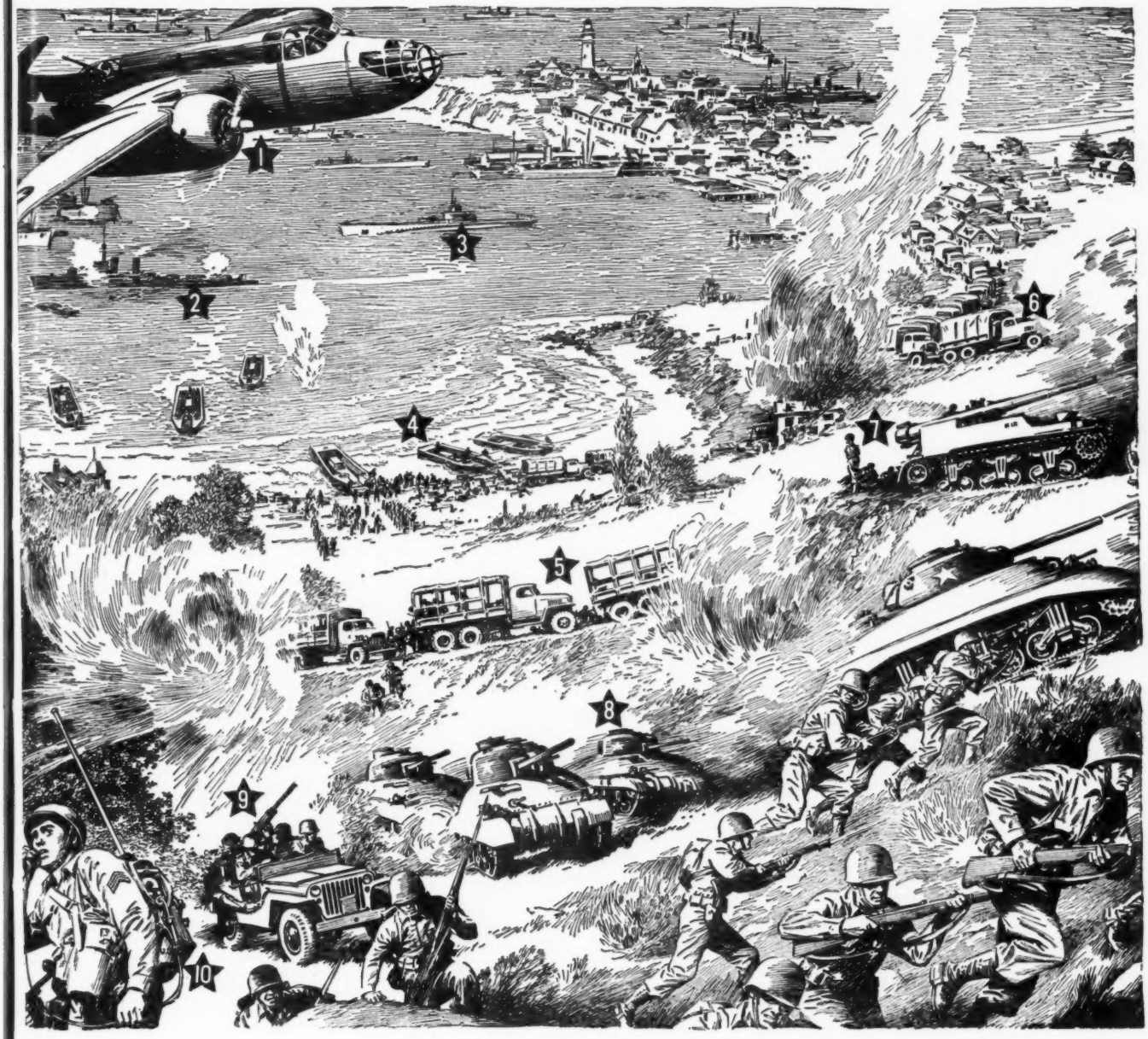
Without batteries...war machines are useless!



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Modern mechanized warfare demands a dependable source of electric power, which, under most conditions, only a storage battery can supply. Our mightiest weapons would lie useless, idle, dead, without such a source of power.

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DAVIS VALVES DAVIS REGULATOR COMPANY

Mr King had served on several committees at the American Petroleum Institute, was a member of the technical committee of the Wire Rope Association, and director of the Iron & Steel Institute of London.

Word has been received here of the death in England on June 19 of **William E Sykes,** authority on gears and inventor of the Sykes continuous tooth herringbone gear and the Sykes gear generating machine. Mr Sykes was formerly associated with the **Farrel-Birmingham Co** at its Buffalo, N. Y., plant, but for the past six years had been in England operating his own plant, W E Sykes, Ltd. Mr Sykes was born and trained in England, receiving his technical education at Leeds University. He joined the Farrel-Birmingham Co in 1923.

R H Allen, formerly a designing engineer specializing in pumping equipment and marine engines at the Fore River shipyard in Quincy, Mass., and Worthington Steam Pump Co at Cambridge, Mass., died at Quincy at the age of 80 on June 20. He retired sixteen years ago.

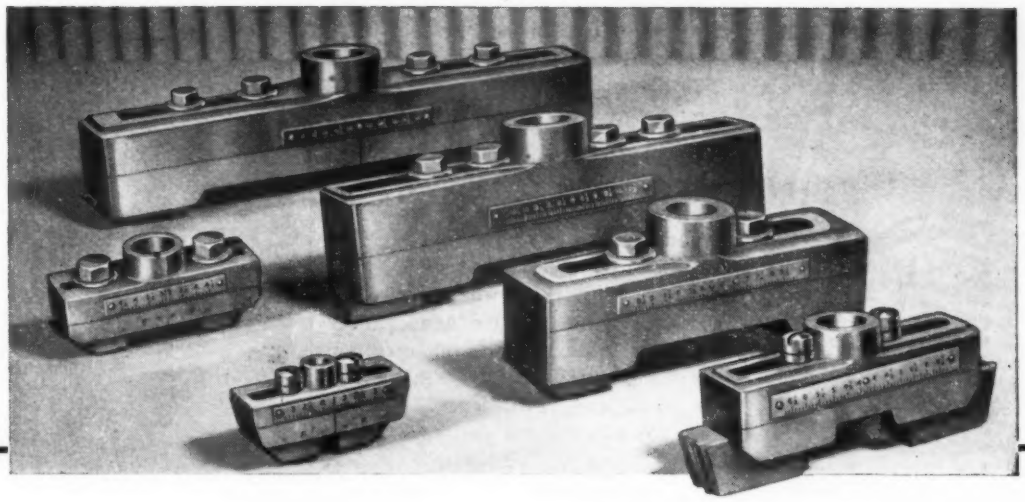
L G Calder, 73, president of the **Bird-Archer Co, Ltd,** and director of the **Bird-Archer Co** of New York City, died suddenly in Montreal, Canada, on June 14. Mr Calder was born in Columbia, Tenn., and received his early education in the United States. In 1929 he went to Montreal, Canada, where he became vice-president and general manager of the Bird-Archer Co, Ltd, and a director of the Bird-Archer Co of New York. In 1932 he became president and managing director of the Montreal company, holding this position until his death.

Phineas W Sprague, 82, president of the **C H Sprague & Son Co,** and cofounder with Samuel Dixon of the New River Co, died at Portland, Me., June 26.

Fred Vogel, 76, retired stationary engineer, died June 29 at his home in Syracuse, N. Y. Mr Vogel was born in Switzerland.

R H Chadwick, assistant to the manager in charge of engineering at the Fort Wayne works of the **General Electric Co,** died May 29, at the age of 51. He joined the General Electric organization in July, 1912, and was made assistant to the manager in charge of engineering in April, 1941.

John Meyer, secretary of **Sauerman Bros, Inc,** died in Chicago May 14, at the age of 46. Mr Meyer was born in Chicago and was engaged in railroad construction and engineering work in



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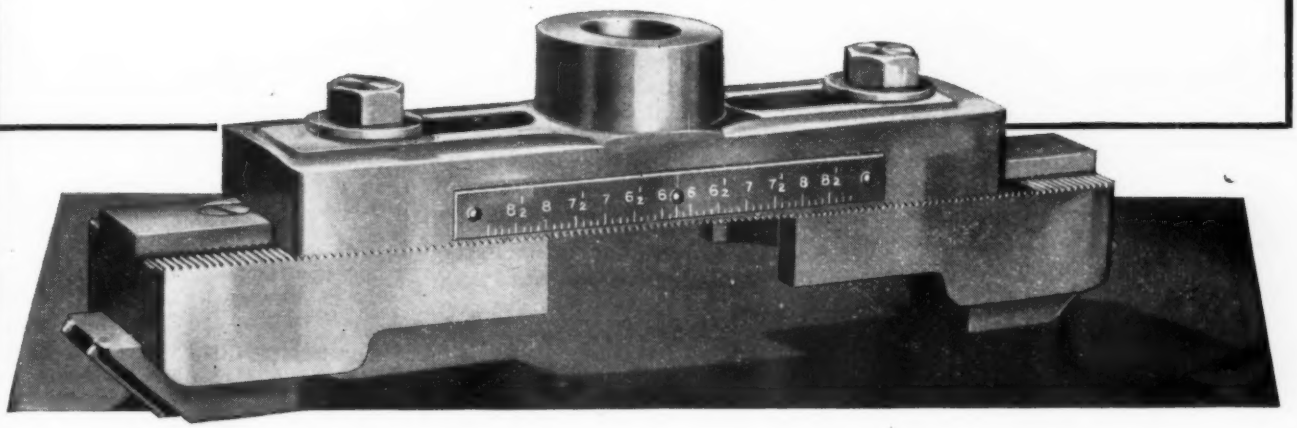

...will completely cover any seat variations
...cut any seat material

The Leavitt Machine Company announces *new-type* cutters and cutter inserts, all of which are available for any Dexter Valve Reseating Equipment now in use . . . all of which have passed tests under every type of condition.

Summed up, here are three important things to remember about this new Dexter Equipment:

(1) The adjustable cutters will adequately cover completely *all* seat variations.

(2) The interchangeable cutter inserts will handle *any* seat angles.

(3) The Tantalum Carbide Tipped inserts will cut *any* seat material.

The cutters are furnished in combinations . . . one combination for all flat seats; other combinations for 45°, 55°, and 75° angle seats. Cutters for reseating seats in 2″ valves and larger are of the adjustable type provided with interchangeable inserts for the different size valves and angles encountered. Cutters for seats in smaller than 2″ valves are covered by our multiple type suitable for reseating the seats of more than one type or size of valve.

For further information about Dexter Valve Reseating Equipment or the new Dexter Cutters write:

LEAVITT MACHINE COMPANY, Orange, Mass.

DEXTER

Valve Reseating Equipment

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REPAIR
RECORDS
Repair of Cracked Pump
The surface of the crack in this pump casing was cleaned and the edges of the crack slightly beveled by a sharp-pointed tool. A putty of SMOOTH-ON No. 1 was then forced into the crack until the crack was filled. No heat or dismantling was required, and the pump was again ready for use as soon as the SMOOTH-ON hardened.
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This many-purpose iron repair cement has been used by plant engineers and maintenance men for almost half a century for sealing cracks and stopping leaks in apparatus.

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Buy SMOOTH-ON in 7-oz., ½-lb., or larger containers from your supply house, or if necessary from us. For your protection, insist on SMOOTH-ON, used by engineers and repair men for over 45 years.

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that city before joining the Sauerman organization as production manager in 1929. He was elected secretary of the company in 1942.

Zechariah Chaffee, 84, president of the Builders' Iron Foundry, Providence, R. I., since 1889, died at his home near Taunton, Mass., on July 8. He was born in Providence, and was a graduate of Brown University, where he served many years as a trustee and member of the corporation. Under his direction the manufacture of the venturi meter was brought to Providence. For ten years Mr Chaffee was secretary of the Brown & Sharpe Mfg Co, Providence.

Dr William J Foster, electrical pioneer and former assistant engineer of **General Electric's** alternating-current engineering department, died at his home in Schenectady, July 2, after a brief illness. He was 82.

Born in Argyle, N. Y., he was graduated in 1884 from Williams College. In 1891 he received the degree of master of science from Cornell University, and became associated with the General Electric Co. at its Lynn works.

From 1893 until his retirement in 1929, Dr Foster took an active part in the design of every important alternating-current machine built by the General Electric Company. For many years, he was responsible for the electrical design of all synchronous machines, and in this way he was a leader in the gradual transition from revolving-armature, smooth-core machines to modern deep-slot, revolving-field machines of greatly increased ratings.

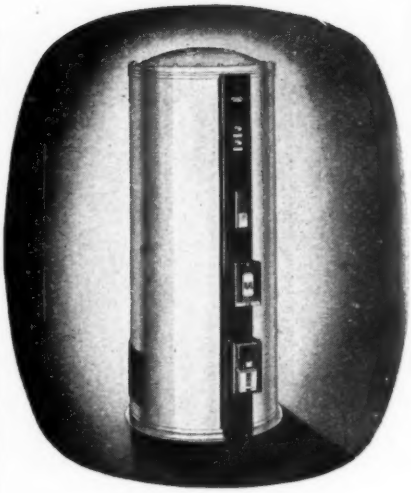
Dr Foster was also an outstanding leader in the development of turbine generator designs. He designed the 5000-kw steam turbine-driven generator, built for the famous Curtis turbine in the Fisk Street Station, Chicago, 1903, which was the first of the modern steam turbine-driven units.

o o o

Carl H Vaupel has been appointed assistant general manager of the **Cooper-Bessemer Corp.** Mr Vaupel joined Cooper-Bessemer early in 1941 and has been devoting the major portion of his time to various managerial duties at the company's Grove City, Pa., plant. . . .

D D Wile has joined the engineering staff of the **Carrier Corp.** Mr Wile was formerly associated with the Detroit Lubricator Co and the refrigeration division of the Savage Arms Co and the Kellogg division of the American Brake Shoe and Foundry Co.

T M Cunningham has been designated general manager of construction and



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Honan-Crane "*Continuous*" Oil Purifiers are now operating in every field where oil is being used. We can give you complete information as to the technique of application and the results accomplished by the purification of any kind of Industrial Oil.

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To Help Increase Wartime Production, Cities Service Offers All Essential Industries A Free Industrial Heat Prover Test!

This test helps to solve combustion problems, reveals how fuel can be conserved, and the quantity and quality of the product increased.

Today, a vast majority of our industrial plants still are without any means of maintaining *accurate* combustion control.

It is to these plants that Cities Service Oil Companies now offer, *without charge or obligation*, a complete combustion control test with the unique, new Cities Service Industrial Heat Prover. This service is available on request in most of the important industrial cities East of the Rocky Mountains.

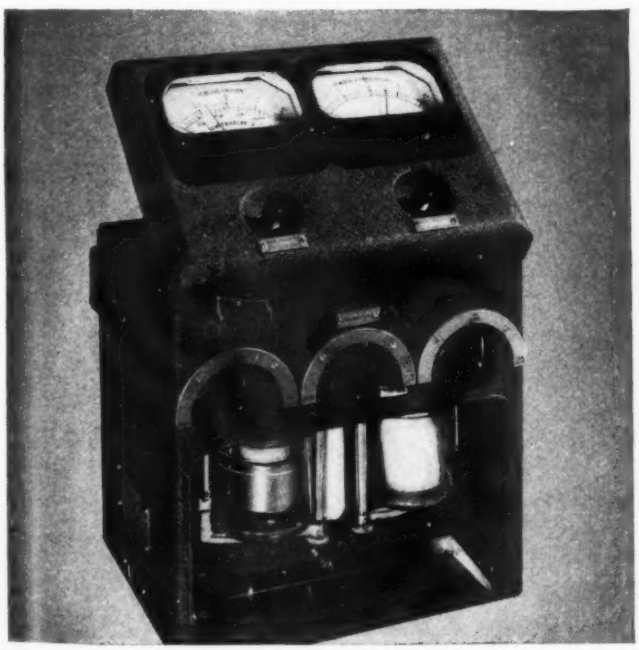
The Cities Service Industrial Heat Prover has been thoroughly tested on practically every type of combustion equipment in this country and with every kind of fuel.

It has been adopted by users of steam power plants, open hearth furnaces, cement kilns, heat-treating apparatus, crucible furnaces and internal combustion engines.

Accurate combustion analysis made as a result of the Cities Service Industrial Heat Prover tests have resulted in considerable savings in fuel costs, have reduced repairs and replacements on furnace linings, crucibles and refractories due to flame corrosion . . . and have led to increased production of better and more uniform products.

Wire or phone your nearest Cities Service office or mail the coupon today—for a Cities Service Industrial Heat Prover test in your plant.

A member of the Cities Service engineering staff will then visit your plant at your convenience and make a Heat Prover analysis of your combustion processes. This engineer has been carefully trained for the purpose, and has at his command extensive information gathered by the Cities Service Research Division from power, metallurgical and chemical fields.



THE CITIES SERVICE INDUSTRIAL HEAT PROVER—a new, accurate combustion analysis instrument—developed by the Cities Service Research Division to enable those engaged in the oxygen control of furnace atmospheres to achieve greater combustion efficiency at less cost.

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Please arrange a Cities Service Industrial Heat Prover test for my plant. I understand there is no charge or obligation for this service.

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ARKANSAS FUEL OIL COMPANY
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Save Fuel GET MORE POWER!

That is what you can do with the TAYLOR BOILER WATER COMPARATOR!

In two minutes, it gives you an accurate check on the pH or phosphate content of your boiler water . . . helps you to prevent scale in your boiler . . . enables you to save fuel, yet attain maximum power.

Equipped with a High (5-100 ppm) or a Low (0-25 ppm) Phosphate Comparator, and with Cresol Red (pH 7.2-8.8) Phthalein Red (pH 8.6-10.2) and Acyl Red pH 10.0-11.6) color slides—the Comparator is very easy to use. Simply add reagent to sample and move slide until a color match is obtained. Then read the content from the values engraved on the slide. Like all Taylor equipment, the color standards carry an UNLIMITED GUARANTEE AGAINST FADING.

Slide and base are molded from durable plastic. The price of $50.00 f.o.b. Baltimore, for the complete outfit makes it a low-cost and indispensable instrument. The elimination of only one descaling job will pay for it many times over!

Write for this FREE booklet TODAY—or ask your dealer about it. Packed with facts and potent information, it has stirred power men all over the country into enthusiastic comment. Don't miss it!

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YORK & RODGERS FORGE RDS. • BALTO.-4, MD.

service of **Carrier Corp,** and **G D Harbin** has been designated regional construction manager of the company's central region. . . . **John L York** has been appointed advertising manager of **Clark Bros Co,** Olean, N. Y.

To head the busy **marine division** of its steam turbine department, the **Allis-Chalmers Mfg Co** has named **W A Yost, Jr,** as manager. Mr Yost was formerly with the Elliott Co of Jeannette, Pa. . . . **David MacGregor** has been appointed chief engineer of the **Edward Valve & Mfg Co, Inc,** with which company he has been associated in various engineering capacities since 1935. . . . **Edmund McCarthy** has been added to the technical staff of the Coal Bureau of the **Upper Monongahela Valley Association.** Mr McCarthy is a graduate mechanical engineer, a licensed professional engineer, and a member of the American Society of Mechanical Engineers. He has had a background of twenty-three years' experience in the fuel engineering field, both in bituminous and anthracite coals.

Thomas Ingledew was re-elected president of the **Institute of Electrical Engineers, Vancouver section,** at that organization's thirty-second annual meeting held recently. Mr Ingledew is chief engineer of the British Columbia Electric Railway Co. . . . **James G Gammel,** formerly industrial brush representative of the **Osborn Manufacturing Co,** has been promoted to technical assistant in brush engineering business at the Osborn home office and factory. . . . **Ralph A Smith,** chief engineer of the Holyoke, Mass., Water Power Co since 1926, has been appointed superintendent of production for the Rockland, N. Y., Light & Power Co. His headquarters will be at Middletown, N. Y.

H J Barnsley, vice-president of Jenkins Bros, has been elected to the governing board of **Jenkins Bros, Ltd,** of Montreal, Canada. Mr Barnsley came to Jenkins Bros. 25 years ago from the Crane Co, where he was chief drafting engineer. . . . **George Johnstone, Jr,** formerly assistant foundry superintendent at the Grove City plant of the **Cooper-Bessemer Corp,** has been promoted to the position of foundry superintendent. . . . **George W Martin,** supervision engineer for the United States Realty and Improvement Co, has resigned as of May 31. Mr Martin, as alumnus of Stevens Institute of Technology, was chairman of the Research Committee, Management Division, Real Estate Board of New York, and is a member of the American Society of

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THE ONLY WRENCH WITH ALL THESE FEATURES . .

- Each head fits two different sizes of nuts
- Positive, instantly reversible ratchet action
- Can be used over long studs
- Does not chew nuts
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Three sizes of handles . . . each handle takes five different heads . . . each head fits two different size nuts. Write for circular and prices. Carried by leading mill supply houses.

PROMPT SHIPMENT assured by large manufacturing facilities. Made by the makers of PALMETTO and other self-lubricating packing.

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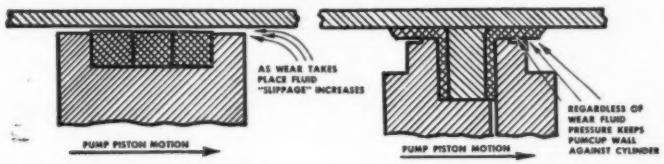
ONE OR A THOUSAND!
you SAVE $100
Per Pump—Per Year

REGARDLESS of the number of reciprocating pumps you operate—*one* or a *thousand*—Darcova Pumcups will start paying dividends the first day! They pay off quickly in—Longer Packing Life—Lower Power Costs—Fewer Shutdowns—Longer Liner Life—Greater Pump Efficiency. Your pumps, *new* or *old,* regardless of present packing, will operate with more efficiency, once this money-saving installation is made.

AN IMPORTANT FORWARD STEP IN PUMPING EFFICIENCY


AS WEAR TAKES PLACE FLUID "SLIPPAGE" INCREASES
PUMP PISTON MOTION
REGARDLESS OF WEAR FLUID PRESSURE KEEPS PUMCUP WALL AGAINST CYLINDER
PUMP PISTON MOTION

ORDINARY PACKING — **DARCOVA PUMCUPS**

From the minute ordinary packing is installed in your pumps, it begins to wear—and with each stroke of the piston there is additional clearance between packing and liner. This means *slippage*—and *slippage* means loss of efficiency. In other words, *with each stroke, the pump efficiency drops,* until it becomes so low that it is necessary to repack the pump. It is important to note that the friction load *is the same* on both load and return strokes.

When *Darcova Pumcups* are installed, constant efficiency is maintained! Because of the cup principle, the fluid pressure presses the side wall out against the liner. This means that, *regardless of wear, there is minimum slippage* (fluid passing between Pumcups and cylinder wall) and *no decrease in pumping efficiency.* Note how upon change of stroke the pressure is released from the inside of the Pumcup so that on the return stroke the *load is less.* This means fewer pump shutdowns and many hours of longer service.

What Are Darcova Pumcups?
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How Much Can I Save with Darcova?
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What Do Tests Show about Darcova Efficiency?
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Why Are Darcovas Best?
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How Are Darcovas Installed?
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Can Darcova Solve My Pumping Problems?
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What about Textures and Sizes?
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Who Makes Darcova Pumcups?
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Write today for complete information that will help you get the most for your pumping dollar.

DARCOVA
THE ORIGINAL COMPOSITION CUP

DARLING VALVE & MANUFACTURING CO.
WILLIAMSPORT, PA.

MAIL THIS COUPON

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Gentlemen: Without obligation, will you please send me complete information on Darcova Pumcups.

Name _____ Title _____
Company _____
City _____ State _____
No. of pumps we operate _____ Make _____
Type _____ Materials pumped _____

The Problem of the Excessive 'Blow-downs'

From ILLCO's Case Book of Boiler Feed - Water Treatment . . .

A MACHINE TOOL PLANT requiring 75,000 gallons of make-up water per day was having trouble with its boilers. The plant's raw water supply contained 631 parts per million of dissolved solids, of which 580 p.p.m. were scale forming.

SEVERAL TYPES OF TREATMENT had been tried but without success, as scale was still forming in the boilers. This necessitated frequent "blow-downs"—extra cost for steam—increased maintenance costs for periodic cleaning. It was agreed that the water should be treated *externally*, so as to *remove* all the detrimental solids *before* they got into the boilers.

TO REDUCE DISSOLVED SOLID content by as much as 80%, and to maintain the correct sulphate-alkalinity ratio, ILLCO engineers recommended a *combination-regeneration* reactor unit. This consisted of two tanks (54" diameter, 72" high) containing ion-exchange material to be *regenerated simultaneously with salt and acid.*

ABSENCE OF SCALE in the boilers was one result of the combination-regeneration equipment. (This salt-and-acid process, pioneered by ILLCO, has demonstrated its excellence for over five years in leading industrial plants.)

OTHER ADVANTAGES: "Blow-downs" were reduced to insurance company's minimum. By thus preventing its boilers from becoming "mud-and-sludge" containers, the plant effected a considerable saving in fuel. Supervision is required only for periodic regeneration. And on comparative cost of chemicals alone, the equipment will pay for itself inside of four years.

WITHOUT OBLIGATION we'll gladly make a similar survey of *your* boiler feed-water problem, suggest recommendations, describe our equipment in detail. Also engineered and manufactured by ILLCO are De-ionizing Units, Softeners, Filters, Aerator, Chemical Processing Equipment, etc. Write for literature.

TESTED IN THE LABORATORY ILLCO-WAY PROVED IN THE FIELD

ILLINOIS WATER TREATMENT CO.
853 Cedar Street, Rockford, Illinois

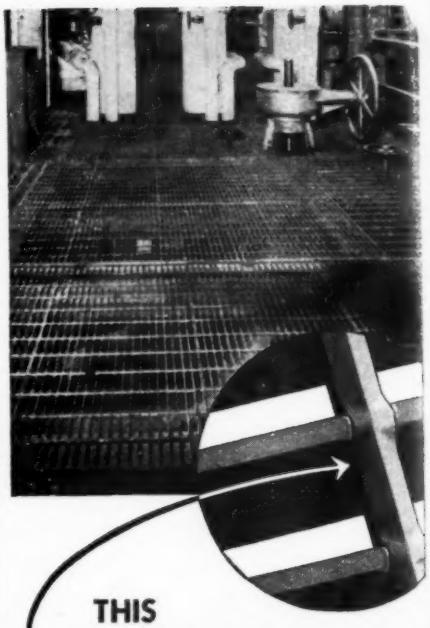
Mechanical Engineers, a life member of of the American Society of Heating & Ventilating Engineers, and a past president of the National District Heating Association.

E J Snetsinger has been appointed general manager of **Magnetrol, Inc,** a newly organized division of the Fred H Schaub Engineering Co. The new division will assume complete control of the manufacture and sale of Magnetrol control units.

Two new departments were formed in a wartime streamlining of the operating organization of **Union Electric Co** of Missouri. **George K Miltenberger** was named superintendent of production and distribution. **Stanley Stokes** was advanced to chief engineer, **George P Gamble** will become superintendent of production in direct charge, under Mr Miltenberger's supervision, of the five steam power plants in the St Louis area, and the two hydro-electric plants in Missouri and Iowa. **E H Tenney,** chief engineer of steam power plants and **Albion Davis,** chief hydraulic engineer, will continue to function in those capacities. **Chris H Kraft,** who was formerly superintendent of distribution, now becomes superintendent of distribution and transmission. **Eugene L Hough** was advanced to chief design engineer, **H E Kleffel,** superintendent of construction, will work directly under Mr Stokes, and the drafting division, headed by **Carl Rulfs,** has been transferred to Mr Stokes' new department of engineering and construction. The drafting division formerly was part of the steam engineering department.

Cochrane Corp announces the appointment of **Metrol Co** as flow meter representative for the Detroit territory. The company is located at 2970 West Grand Boulevard, Detroit, and will also handle Hays combustion control and instruments, Reliance gage columns and Wilson tube cleaners. . . . Announcement has been made of a **Joint Fuels Conference** of the American Institute of Mining Engineers and the American Society of Mechanical Engineers to be held at the William Penn Hotel, Pittsburgh, Pa., October 28 and 29. **A general committee** consists of T E Purcell, chairman, H F Hebley, L E F Wahrenburg, A W Thorsen, T J Barry, and H P Greenwald. . . . **Alfred C. Marshall,** president and general manager of the **Detroit Edison Co,** was awarded the honorary degree of Doctor of Arts in Business Administration on June 17 at Wayne University.

Sylvania Electric Products, Inc, an-



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OPEN STEEL FLOORING
GIVES THE
COMBINATION OF SAFETY AND CLEANLINESS
YOU WANT IN OPEN STEEL FLOORING

This extra cleanliness and safety come with the use of welding technique that, for years, has been recognized as the correct method to follow—a simple fillet weld.

There is no burning and no overflow of surplus metal around the fillet into which is press-welded Bates Hex Bar Stock. You get top strength and rigidity in steel flooring that permits the maximum passage of air and light.

Write for the new catalog "FILLET WELD BATES - GRATES" that gives complete details—well illustrated to show how advantages of this open steel flooring can be used in your plant.

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OPEN STEEL FLOORING • STAIR TREADS

In every submarine, battleship, cruiser, plane and freighter, as well as in every plant manufacturing war products, there are valves. What would happen if any of these valves failed in an emergency?

Because Fairbanks Valves proved their dependability, efficiency and long life in pre-war work for more than half a century, thousands of them have already gone into war service.

You can "Bank on Fairbanks Valves." They are quality built through and through. Nothing is spared in the cost of materials and labor to make them as perfect as possible. Every part, as well as the finished valve, is carefully tested. Everything must be right before they are permitted to leave our factory.

Fairbanks Valves are made in bronze and iron, in types and sizes for practically every service.

Write for catalog No. 42 and name of our nearest distributor.

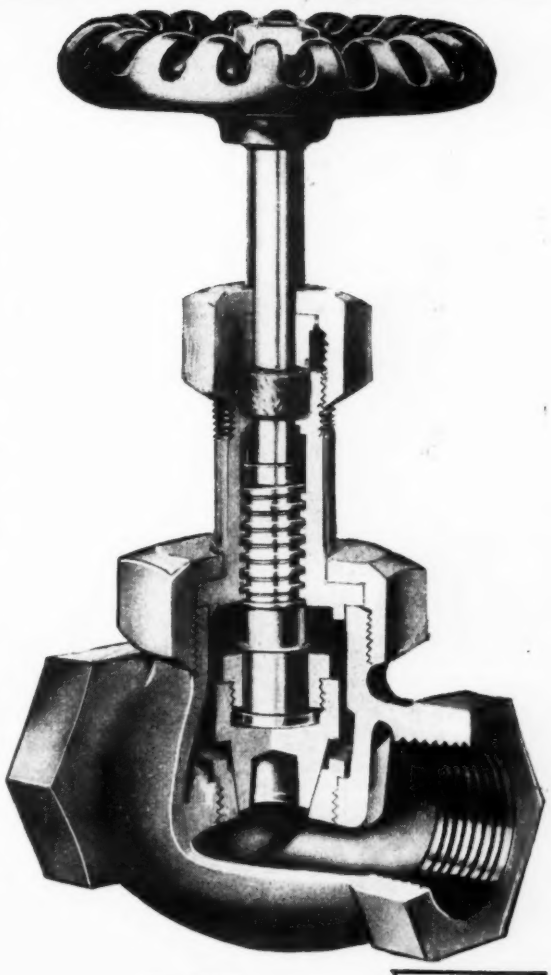


Fig. 0501P

THE FAIRBANKS COMPANY

393 Lafayette St., New York, N. Y.

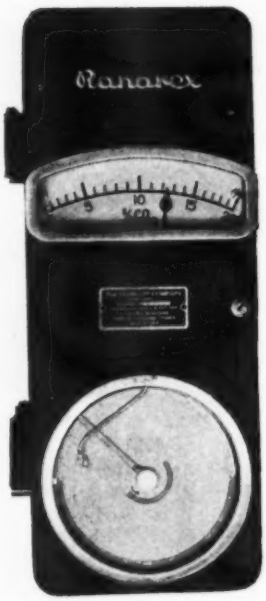
Boston, Mass. Pittsburgh, Pa.

Distributors in Principal Cities

Fairbanks *Standard and* Renewable Valves

SAVE FUEL

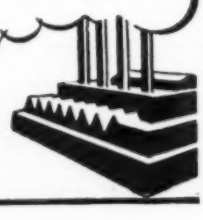
with this simple instrument



Just glance at the needle on the Ranarex scale. That tells you the CO_2 in flue gases. Then you can adjust combustion until the percentage of CO_2 is at the point that gives you the *most* power from the fuel you burn. Ranarex is tough—has no fragile parts to get out of order. Yet it gives instant readings, accurate within 3/10 of 1% CO_2. It operates on ordinary lighting circuit, requires no skilled operator.

Write for free booklet: The Permutit Company, Dept. A, 330 West 42nd St., New York 18, N.Y.
In Canada: Permutit Company of Canada, Ltd. Montreal . . . Winnipeg . . . Toronto . . . Calgary.
*Trademark Reg. U. S. Pat. Off.

RANAREX
cuts heat loss up-the-stack



Product of PERMUTIT

nounces the formation of an international division with **Walter A Coogan** as director. As part of its expanded activities the international division will include the operations formerly carried on by the foreign sales department. . . . Purchase of **Quimby Pump Co,** with plants at Newark and New Brunswick, N. J., by **H K Porter Co,** Pittsburgh, Pa., has been announced by T M Evans, president of the Pittsburgh firm. The Quimby plants will be operated as a division of the H K Porter Co.

Babbitt Industrial Specialties Co, of New York, and New Bedford, has taken over through merger, the development, manufacture and sale of the industrial sealing compounds formerly made by **Nameo, Inc,** of Nutley, N. J. . . . **The Clark Brothers Co** of Olean, N. Y., has completed a $4,000,000 contract for small diesel electric generating units used to replace war-damaged power facilities in small Russian plants behind the lines. The U S government has awarded the Clark concern a $3,000,000 contract for similar engines.

The General Electric Co announces: **J C Mahoney,** superintendent of the turbine and marine installations section of the service engineering division since 1922 retired June 1. He is succeeded by **T W Howard. E D Dickinson,** designing engineer of the turbine engineering division at the Lynn River Works, has retired after 43 years of service with the company. At the time of his retirement Mr Dickinson was **the oldest turbine engineer** in the General Electric Co both in age and service, and had a longer service record in turbine engineering than any other engineer in active service in the world today.

The control of the **Nicholson Co, Inc,** has been purchased by Wininger & Selby, Inc. . . . In the June issue of POWER, page 202, an item stated that Mr Keith Powilson had been appointed as president and controller of the **Armstrong Cork Co.** This is an error. **H W Prentis, Jr,** is **president** of the Armstrong Cork Co; Mr Powlinson has been elected **vice-president** and controller.

George M Diebold was re-elected president of the Keystone Association 16, **National Association of Power Engineers.** Other officers are: **Thomas McKee,** vice-president; **Lehnard W Thiels,** corresponding sercretary; **Frank W Savage,** recording secretary; **William L Buchs,** financial secretary; **Herbert J Thielke,** treasurer; **Julius Habish,** conductor, and **Angel L Doldan,** doorkeeper. Preceding the election the group

A Simple Way To Make Refractory Lining Last Longer . . .

An application of Brickseal, a semi-plastic, highly glazed, monolitic coating, prevents refractory linings from developing minute cracks or fissures in brick joints when forced to undergo rapid changes in temperature. Once on, Brickseal will not crack, peel, or blister and . . . fuel oil and combustion gases do not impair it. Brickseal also rebinds brick already cracked or loosened.

BRICKSEAL REFRACTORY CO.
1029 CLINTON ST.
HOBOKEN, N. J.

CONTINUE TO "GUARD THOSE VALVES"

Since such tremendous tonnage must be carried to forces around the globe, it is easy to understand why Reading-Pratt & Cady for so long have advised you to "guard those valves." Ships are a maze of valves. ★ Strides toward victory should not encourage the thought that the transport of matériel for fighting Americans be put in jeopardy—so that we at home might have more. Now is the time to put into war every ounce of drive we can muster. Continue to guard your valves.

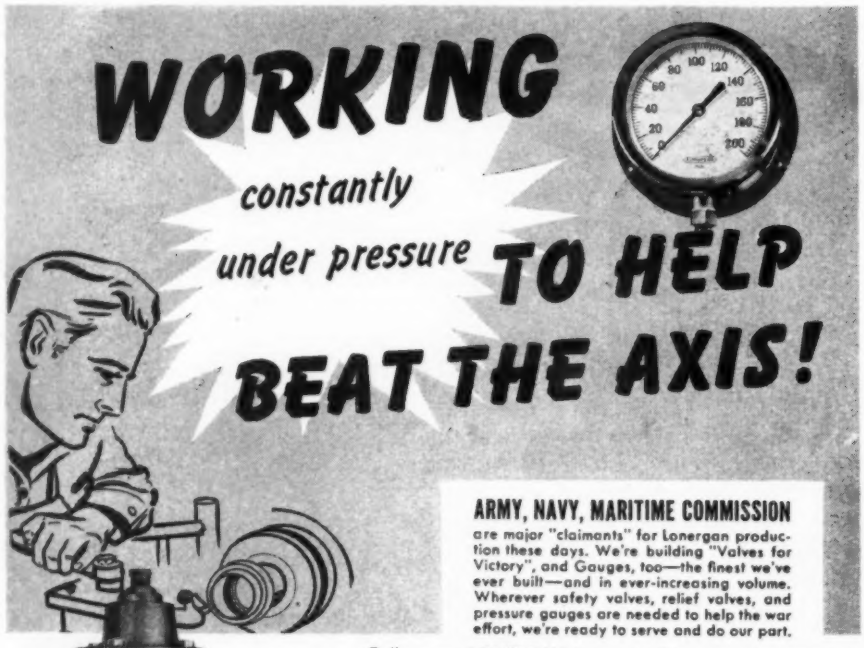
READING-PRATT & CADY

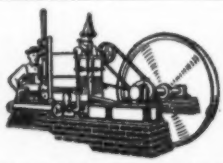
MANUFACTURERS OF

READING CAST STEEL VALVES AND FITTINGS • PRATT & CADY BRASS AND IRON VALVES
D'ESTE VALVE AND ENGINEERING SPECIALTIES

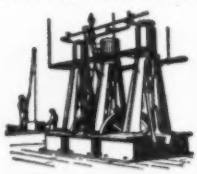
Reading, Pa., Atlanta, Boston, Chicago, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Portland

A DIVISION OF **AMERICAN CHAIN & CABLE COMPANY, Inc., BRIDGEPORT, CONNECTICUT**

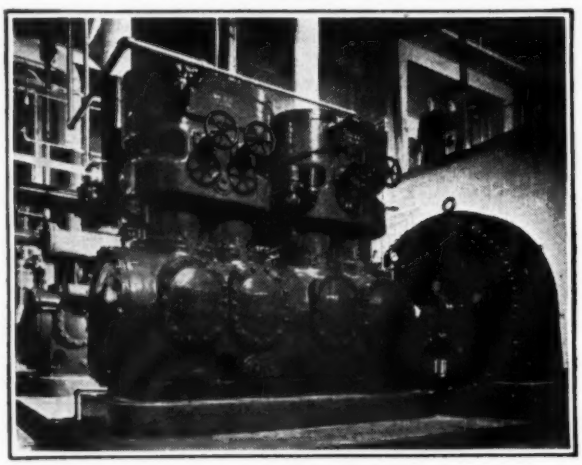

WORKING
constantly
under pressure
TO HELP
BEAT THE AXIS!
ARMY, NAVY, MARITIME COMMISSION
are major "claimants" for Lonergan production these days. We're building "Valves for Victory", and Gauges, too—the finest we've ever built—and in ever-increasing volume. Wherever safety valves, relief valves, and pressure gauges are needed to help the war effort, we're ready to serve and do our part.
Call on us. LONERGAN is prepared to serve as your first line of supply for precision safety appliances.
Lonergan
—SINCE 1872—
SIGN OF PROGRESSIVE ENGINEERING!
J. E. LONERGAN COMPANY • 215 Race St., Philadelphia, Pa.
SAFETY & RELIEF VALVES • PRESSURE & VACUUM GAUGES • SPECIALTIES



FRICK STEAM ENGINE, BUILT 1856
NOW IN THE FORD MUSEUM



FRICK REFRIG. MACHINE OF 1883



90 Years' Engineering Experience Stands Behind

TRADE FRICK MARK

To be within ten years of its One Hundredth Anniversary is a distinction enjoyed by very few companies in America.

Frick Company was established in 1853 for the building of steam engines. The success of these led to the construction, in 1882, of the first Frick Refrigerating machine.

Today, Frick cooling systems are put into war service as fast as they can be made. Tomorrow, you can get the advantages of up-to-date Frick Refrigerating, Ice-making, and Air Conditioning Equipment, backed by more than 90 years' experience.

FRICK COMPANY, WAYNESBORO, PENNA., U. S. A.

Refrigeration

named Mr Diebold general chairman for the association's national convention to be held September 1 to 3 in the Hotel Statler, Buffalo.

The Fourth Annual Water Conference of the Engineers' Society of Western Pennsylvania, will be held in the William Penn Hotel, November 1 and 2, 1943.

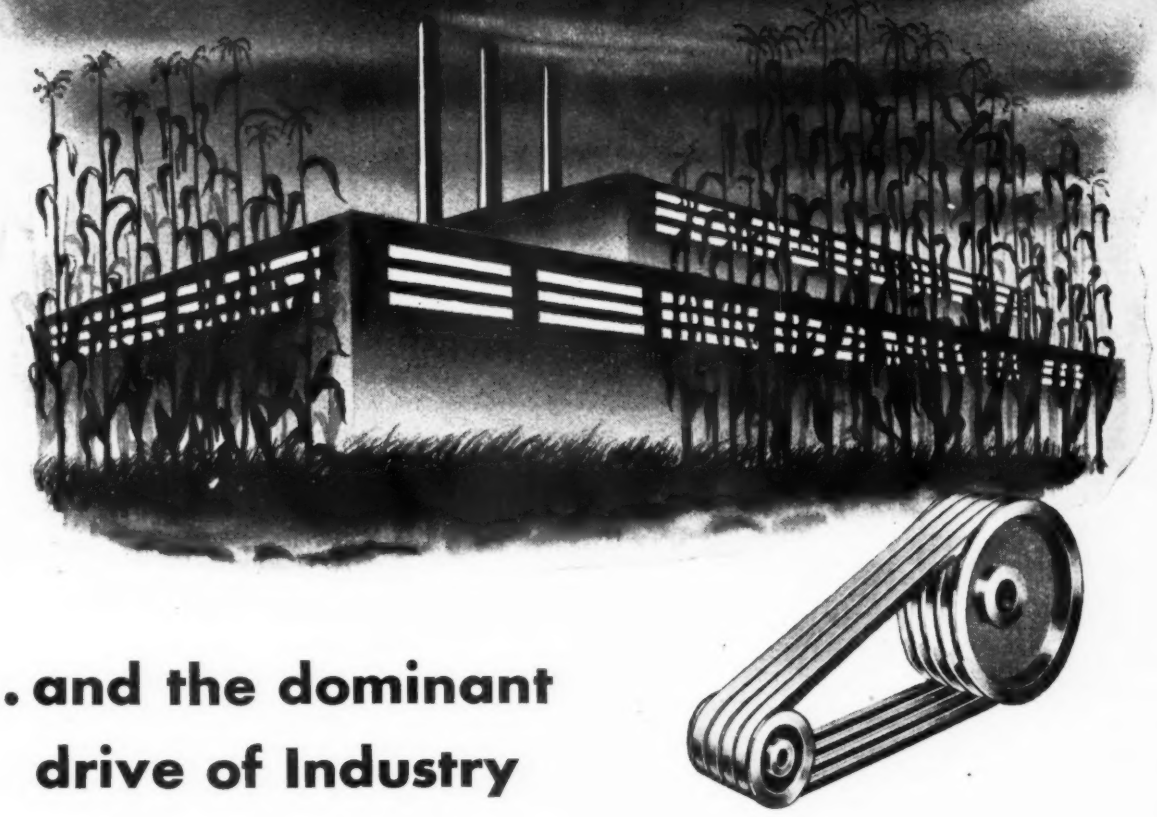
The Cleveland Diesel Engine Division of **General Motors Corp** has opened a Pacific Coast service office in the Sutter Bldg, 111 Sutter St, San Francisco, Calif. The office is in charge of Charles C. Cheevers.

The mechanical underfeed coal stoker industry's second annual war conference and the 24th annual meeting of the **Stoker Manufacturers' Association** proved to be the most successful gathering in the history of the industry, according to a release from the association. The association approved recommendations by the Engineering & Research Committee (1) to establish minimum firebox dimensions for stoker-fired boilers and furnaces from the small domestic sizes to commercial and industrial boilers having a capacity of 1200 lb of coal per hour, stoker-fired; (2) to establish a uniform method of rating and testing stokers; (3) to affix SMA plates to all stokers of member companies meeting test requirements certifying the feeding rate of various size stokers: and (4) approval of a statement prepared by the committee based on the experiences of thousands of stoker installations concerning the dustless treatment of stoker coals with hygroscopic salt base solutions. **John M McClintock**, manager, stoker division, Illinois Iron & Bolt Co, Chicago, was re-elected president for another year.

For the first time in history a single power plant has operated at more than a million kilowatt capacity, Secretary of the Interior Harold L Ickes announced June 21. The plant is the Boulder Dam installation on the Colorado River in Arizona and Nevada operated by the Bureau of Reclamation. News of the record-breaking output, first reached on June 11, was brought to the Secretary by the Bureau's Acting Commissioner, Harry W Bashore. He explained that the previous highest instantaneous peak load occurred on Jan. 7, 1943, when slightly more than 900,000 kw were generated.

To help increase pig iron production at existing plants and to expand America's output of steel, the Bureau of

AMERICA'S WAR PRODUCTION MIRACLE



...and the dominant drive of Industry

The epic of America's switch from the production of civilian goods to war matériel is now history. The original demands of the military seemed like wishful thinking—impossible of fulfillment. But the impossible became a reality. Today, from converted industries and from factories which have literally sprung up in cornfields a stream of planes and tanks and guns is reaching flood stage, eventually to engulf the enemy by its sheer preponderance.

That the Multiple V-Belt Drive contributed in no small measure to the victory of the battle for production is also a matter of record. Thanks to co-operative engineering research and interchange of laboratory and field information among members of the Multiple V-Belt Drive Association, the Dominant Drive of Peace became the Dominant Drive of War.

With proved engineering and performance, and standardized sheave and belt sizes, the miraculous multiplication of America's industrial output has been accomplished with speed and precision. And, with the return of better days, the Multiple V-Belt Drive will expedite readjustment of our industrial machine to the job of meeting America's pent up demand for the things of peace.

The use of this emblem by an association member in connection with Multiple V-Belt Drives is assurance of mechanical excellence...the result of co-operative engineering, research and experience.

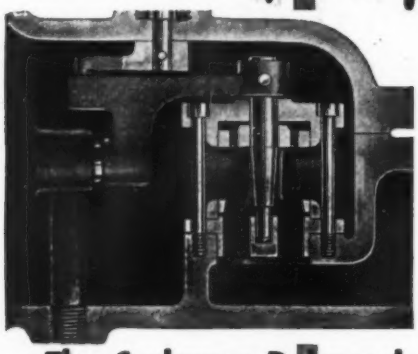
MULTIPLE V-BELT DRIVE ASS'N

Trade Mark

MULTIPLE V-BELT DRIVE ASSOCIATION

140 SOUTH DEARBORN ST., CHICAGO

The Secret of this Drainer's Great Capacity



The Cochrane Balanced Rotary Multiport Valve

COCHRANE DRAINERS are famous among power plant operators for their tremendous discharge capacity. Wherever large quantities of condensate must be continuously removed as from evaporators, heaters, separators, coils or steam lines, under vacuum or positive pressures, Cochrane Drainers are specified by experienced plant men. The secret lies in their multiport valve construction, a series of longitudinal parts in the rotary valve matching similar parts in the stationary valve sleeve. The height of the condensate in the drainer body thus automatically determines the rate of discharge.

Write for a copy of Publication 2925

COCHRANE CORPORATION
3706 N. 17th St., Philadelphia, Pa.

COCHRANE
STEAM SPECIALTIES

CURRENT ARMY E NAVY AWARDS

Philadelphia Gear Works, Inc. Award presented recently.

Air Reduction Co. Maritime "M" Award presented July 17, 1943.

Armstrong Cork Co, Lancaster plant. White Star Award presented June 28.

Wickwire-Spencer Steel Co. Gold Star Maritime "M" presented June 11, 1943.

Sullivan Machinery Co. Award presented May 14.

Sylvania Electric Products, Inc. White Star Award presented to Emporium plant June 22.

De Laval Steam Turbine Co. Two-Star Award presented recently.

Philco Corp, Simplex Radio Division. White Star Award presented June 29.

Revere Copper & Brass, Inc, Baltimore Division. Award presented July 8, 1943.

Homestead Valve Mfg. Co. Gold Star Maritime "M" Award presented recently.

Cleaver-Brooks Co. Award presented recently.

Link-Belt Co, Ewart plant. Award presented recently.

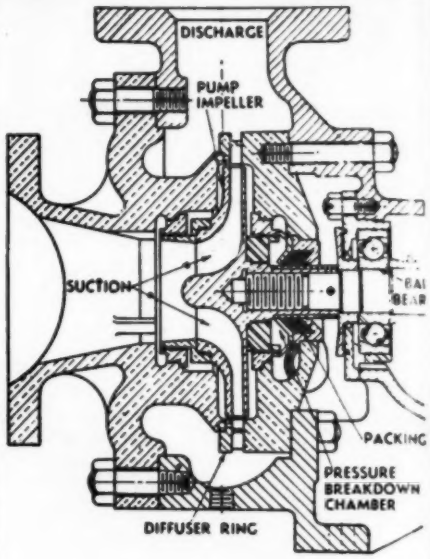
Builders Iron Foundry. Star Award presented recently.

Ampco Metal, Inc. Award presented May 16.

American Locomotive Co. Award presented Latrobe plant May 25.

Mines has published a report outlining possible methods for improving the quality and uniformity of blast furnace coke, according to **Dr R R Sayers,** director of the bureau. Based on a preliminary survey of plants producing and using coke, the report discusses modifications of ordinary mine and plant practices offering the greatest promise in making coke required for the maximum production of pig iron.

The Westinghouse Electric & Mfg Co has published a new Operating Guide which contains **operating and maintenance suggestions and inspection charts** for their single retort stokers. The booklet gives operating and maintenance suggestions regarding instruments, air requirements, operation, fuel



ONLY LOW PRESSURE DUTY REQUIRED OF SOFT PACKING WITH THE

COFFIN-Steam Turbine CENTRIFUGAL PUMP

TWO wearing rings mounted in the pump casing and the suction head, together with the rotating wearing ring sleeve mounted on the impeller, form the high pressure packing.

The outboard ring leaks back to suction and the inboard ring leaks into a pressure breakdown chamber from where it is piped to the suction or feed source.

This system limits the pressure to be packed by the soft packing to suction pressure and insures long wear from the self-adjusting packing along the impeller hub.

Send for Bulletin I-22

THE J. S. COFFIN, JR. Co.

ENGLEWOOD, N. J.

Can You Answer These Questions ON VALVE SELECTION?

TODAY, when it is more important than ever before to keep pipe lines flowing at maximum efficiency, too much care cannot be given to selecting the right valve for each job. Before you "draft" a valve for that all-important line, make sure it is the one you really need.

Here are answers to two frequently asked questions on valve selection, taken from the files of The Kennedy Valve Manufacturing Co. Other problems will be considered in succeeding advertisements in this series.

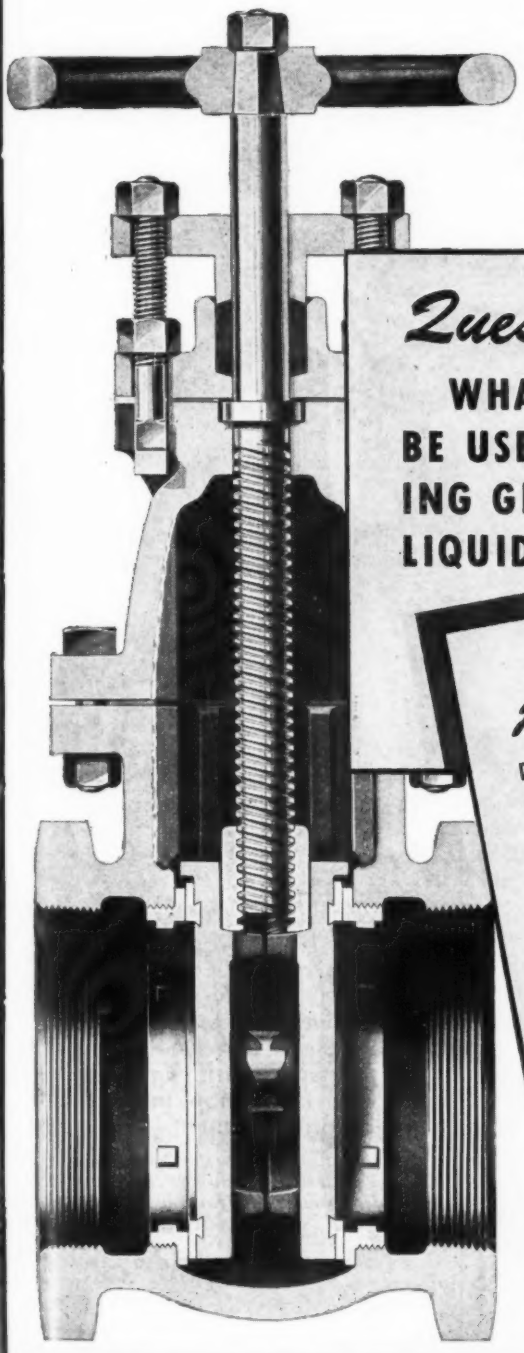


Fig. 2

Questions:

WHAT KIND OF VALVE SHOULD BE USED FOR LIQUIDS CONTAINING GRIT? FOR GUMMY LIQUIDS?

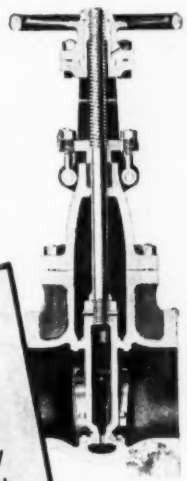


Fig. 1

Answers:

Double-disc gate valves (Fig. 2) are preferable where liquids containing grit are to be handled, because the flexibility of their operating mechanism enables one disc to seat tightly if grit is caught on the other seat, and also because the discs and seats are more readily refaced than those of wedge gate valves. Wedge gate valves (Fig. 1) are used where gummy liquids are handled, and are preferred for steam service by some engineers and operators.

USE DOUBLE-DISC GATE VALVES FOR LIQUIDS CONTAINING GRIT . . . WEDGE GATE VALVES FOR GUMMY LIQUIDS.

If you have a valve selection problem, write to us. As Kennedy makes a complete line of standard gate, globe, angle and check valves, you can be sure of receiving unbiased help. For full description of Kennedy valves, pipe fittings and fire hydrants, send for 240-page Kennedy Catalog.

KENNEDY VALVES • PIPE FITTINGS • FIRE HYDRANTS
THE KENNEDY VALVE MFG. CO. • ELMIRA, N.Y.

ROCKWELL BLAST GATES

Threaded Slide Type of Rockwell Blast Gate

For Accurate Control of Low-Pressure Air

There are plenty of good reasons for the wide popularity of Rockwell Blast Gates. These air-tight, non-chattering blast gates are designed for strength, lightness and accurate control. Available in all desirable types, sizes and methods of operation. They save power . . . money . . . time. Write for Bulletin 4020 describing Rockwell Blast Gate advantages in detail.

W. S. ROCKWELL COMPANY
Blast Gate Division
50 CHURCH STREET NEW YORK 7, N. Y.

PLASTIC PATCH

Takes Traffic Immediately . . .

Here's a new, fast way to patch broken concrete without having to close off the area. Use durable INSTANT-USE . . . a tough, plastic material which you simply shovel into hole—tamp—and run traffic over immediately. NO WAITING. Bonds tight to old concrete. Makes smooth, solid, heavy-duty patch. Withstands extreme loads. Keep a drum on hand for emergencies. Immediate shipment.

Request Descriptive Folder . . . and Details of

FREE TRIAL OFFER

INSTANT-USE
FLEXROCK CO., 2377 Manning St., Phila., Pa.

distribution, ash and clinker, boiler and furnace structure, coal segregation, automatic regulation, steam drive, hydrofeed drive, link-grate stokers and stationary grate stokers. Part II of the new booklet contains 12 inspection charts covering individual groups of equipment for single retort stokers. A copy of this booklet, B-3257, may be secured from Dept. 7-N-20, Westinghouse Electric & Mfg Co, East Pittsburgh, Pa.

Many problems of wartime production, manpower and materials supply were discussed in the 55th annual meeting of the **American Boiler Manufacturers Association and Affiliated Industries**, June 6 to 9. As usual, the meetings were held at the Skytop Lodge, high in the Pocono hills. **F H Daniels**, president of Riley Stoker Corp. was reelected president of the ABMA & AI, and **A C Weigel**, vice president of Combustion Engineering Co. was given another term as vice president. **A C Baker**, secretary and treasurer for many years, was reelected.

In the Associate Members group, representing such parallel activities as boiler accessories, insurance and publishing, **Philip Swain**, editor of POWER, was elected chairman to succeed J P H deWindt, National Bureau of Safety and Casualty Underwriters. New secretary of the Associates is **C O Myers**, National Board of Boiler and Pressure Vessel Inspectors.

Speakers included R M Hatfield, chief, Boiler Section, Power Division, War Production Board, and Dr H K Ihrig. Dr Ihrig, who is chief of scientific activities and research at the Globe Steel Tube Company, talked on the Romance of Metals. In particular he showed the versatility of iron and steel in their various forms—for example the conversion of certain steel alloys to a non-magnetic condition by heat treating.

Mornings were devoted to business, afternoons to recreation. Among the various awards for sports, outstanding was the award of the E H Wells golf trophy to E V Quinn, Edge Moor Iron Works. Originally donated by Babcock and Wilcox Company, this big silver cup goes permanently to Mr Quinn for this third winning of the ABMA & AI golf championship (36 holes low gross).

The Corresponding Associate Members Championship for the year was won by J E Fleming of National Tube Company, who acquired one-year custody of the Paul B Huyette Trophy.

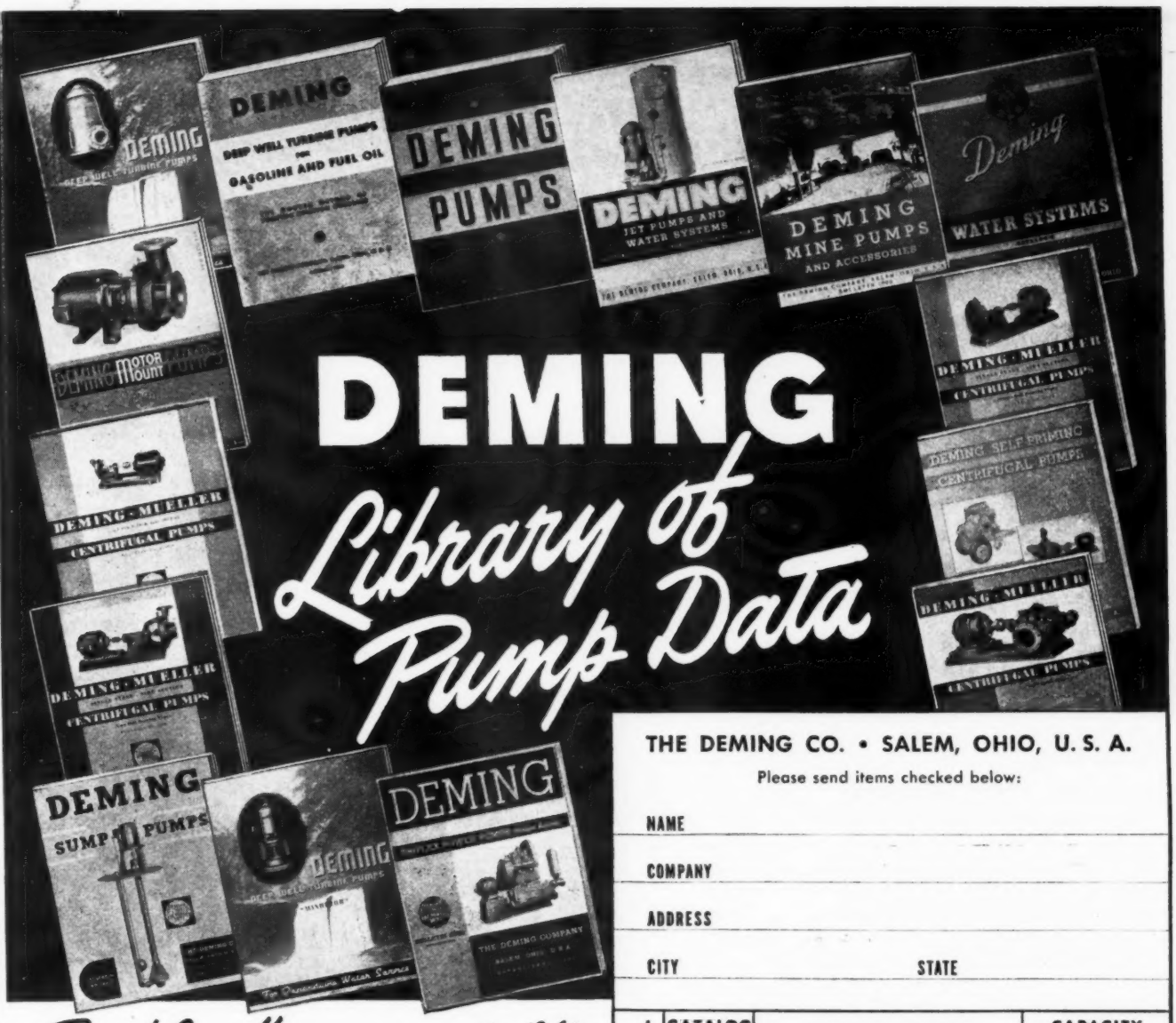
prevent pressure losses

● In force-feed lubrication of bearings, use *babbitt-tipped* Laminum shims to prevent oil and pressure losses. Shims cut to your specifications provide accurate laminations for quick precision adjustment.

Shims cut to your specifications. Stock shim materials obtainable from your dealer. Write us for further information and shim application chart.

Laminated Shim Company
Incorporated
61 Union Street • Glenbrook, Conn.

LAMINUM
THE SOLID SHIM THAT peels FOR ADJUSTMENT
2045



DEMING *Library of Pump Data*

Send for all or any part of it

Note the form at the right. It lists 15 different catalogs and bulletins prepared to help you locate the most suitable Deming pump or water system for specified requirements. A wide diversification of types, sizes, and capacities are covered by this "Deming Library of Pump Data."

Check the item or items in which you are interested; fill in your name and address; and mail the form to us. Your request will receive prompt attention. No cost to you, of course.

THE DEMING COMPANY · SALEM, O.

DEMING *Pumps*

THE DEMING CO. • SALEM, OHIO, U. S. A.

Please send items checked below:

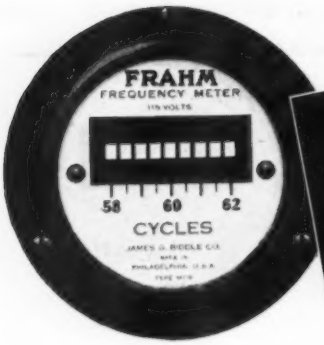
NAME

COMPANY

ADDRESS

CITY STATE

✓	CATALOG NUMBER	TYPE OF PUMP	CAPACITY RANGE
	4700-8	Deep Well Turbines	15 to 3000 G.P.M.
	4701	Minuturb Deep Well Turbines	15 to 80 G. P. M.
	4200	Single-Stage, Side Suction, Two Ball Bearing Centrifugal Pumps	10 to 3600 G.P.M.
	4006	Single-Stage, Side Suction, Single Ball Bearing Centrifugal Pumps	10 to 3600 G.P.M.
	4301	Motor Mount Centrifugal Pumps	5 to 650 G.P.M.
	5003	Single-Stage, Split Case Centrifugal Pumps	Up to 5000 G.P.M.
	3900-A	½, ¾, 1 and 1¼ inch Side Suction Single Ball Bearing Centrifugal Pumps	2 to 80 G. P. M.
	3000	Self-Priming Centrifugal Pumps (Portable and Stationary types)	10 to 300 G.P.M.
	1000	Mine Dewatering Pumps	Wide Range
	4603	Sump Pumps. Vertical types	10 to 3200 G.P.M.
	4700-G	Turbine-type Gasoline and Fuel Oil Pumps	15 to 1000 G.P.M.
	300-B	Triplex Power Pumps—Single Acting	Wide range
	Catalog "E"	Water Systems—All Types	All capacities
	J-4900-B	Jet Pumps and Water Systems	200 to 4500 G.P.H.
	Catalog "33"	Complete catalog. General line	All capacities



A MINIATURE FREQUENCY METER THAT IS RELIABLE!

IDEAL FOR DIESELS

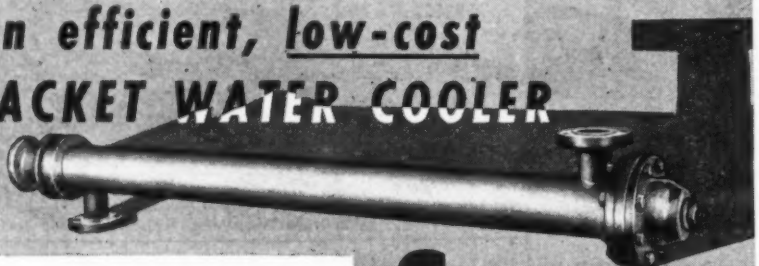
Frahm Vibrating-Reed Frequency Meters are widely used on Diesel-electric and other power installations where close control of generator frequency is imperative.

This Miniature Frahm Vibrating-Reed Frequency Meter is an indicating instrument without moving system or pointer. The operating principle and the method of indication are based on resonant vibration of accurately tuned steel reeds. These instruments are easy to read, ruggedly constructed, surprisingly accurate over long periods of time and are unaffected by wave form or by ordinary changes in voltage and temperature. Available in various ranges of power frequencies from 15 to 500 cycles per second; in fact, the same instrument can have more than one range. Larger switchboard and portable types of Frahm Frequency Meters are also available for a variety of ranges and for various potentials.

Write for Bulletin 1695-P describing all types.

JAMES G. BIDDLE CO. • 1211-13 ARCH STREET PHILADELPHIA 7, PA.

An efficient, low-cost JACKET WATER COOLER



*Patent Appl. For

SHELLFIN*

The STANDARDIZED shell & finned tube HEAT EXCHANGER

Mass-produced SHELLFIN is the economical cooler; it eliminates expensive individual engineering!

● When you want a good cooler—and in a hurry—specify Shellfin, the standard design heat exchanger that's built on a cost-saving, time-saving production basis!

SHELLFIN units are . . . (1) RUGGED (500 pound test if you wish). (2) EASY TO USE—In a few minutes one man can take one apart for inspection and cleaning. (3) QUICKLY AVAILABLE—if you can use one of several popular sizes.

Write for Bulletin which describes Shellfin construction features and gives dimensions. Ask for a quotation on Shellfin units for your requirement.

DOWNINGTOWN IRON WORKS
DOWNINGTOWN, PA.
HEAT EXCHANGERS

Both Scrappers

Those gnarled hands can still turn in a full day's work—and that oil-encrusted Ludlow can still valve oil with the best of them. All either one needed was the opportunity that war provided. Why not check up on your retired valves? You may well find that a few replacement parts will fit them for continued service — particularly Ludlows.

Now that you think of it—hasn't this more-than-average service always been a Ludlow characteristic? For these extended-service valves, Ludlow will aid in supplying the same enduring replacement parts. Check up on your priority and send in your order.

THE LUDLOW VALVE MFG. CO., INC.
TROY, NEW YORK

Construction Features: Self-releasing 30° angle wedges and free-floating gates, self-adjusting to seats, afford smooth, trouble-free performance, long service. Rings are cleaned throughout stroke action. Gates are wedge-locked directly opposite ports and completely unwedged before raising. Ample tolerances provide easy action. Simple construction permits easy replacement of parts.

V-15

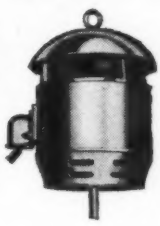
LUDLOW VALVES

SINCE 1866

FLANGED END HEADS SIMPLIFY Vertical MOUNTINGS OF R&M Uni-Shell INTEGRAL HORSEPOWER MOTORS

VERTICAL MOTORS WITH DRIP-PROOF COVERS

Vertical *Uni-Shell* Motors with drip-proof cover and special base. A wide variety of flanged end heads, ring, and tripod bases are available.



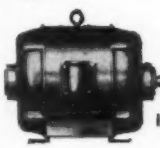
The vertical D. C. motor is made drip-proof with special end head covers. All flanged heads or lower bases developed for other types are available for D. C. frames.

Vertical type of capacitor-start induction run motor with drip cover and external capacitors. All flanged heads are completely interchangeable for all motor types.

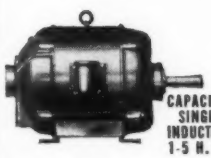
All of the motors shown above use the same flanged head, but many other flanges, standard and special, can be supplied. It is important to remember that such heads are interchangeable for Single-Phase D.C. and Polyphase motors.

ONLY END HEADS CHANGE

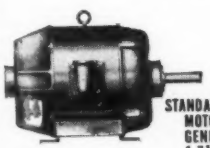
Every dimension, from Uni-Shell motor body to head fit, is identical for all motor types.



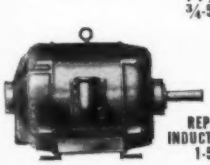
POLYPHASE INDUCTION MOTOR 1-30 H. P.



CAPACITOR-START SINGLE-PHASE INDUCTION MOTOR 1-5 H. P.



STANDARD D. C. MOTOR AND GENERATOR 1-7½ H. P. ¾-5 K. W.



REPULSION INDUCTION MOTOR 1-5 H. P.

COMPLETE INTERCHANGEABILITY IN ANY ONE FRAME SIZE

The R & M Uni-Shell Motor represents the development of a revolutionary idea in electric motor design. In all types of Uni-Shell motors, the shell length, diameter, base mounting holes, shaft dimensions, height of shaft above base, head fit and bolt circle mounting for heads are exactly the same for any frame size. Only the end opposite the shaft extension varies from one type to another and then with only a slight change in external appearance.

And even beyond this complete interchangeability, R & M Uni-Shell Motors are far in advance—the finest and longest-lived motors that R & M has built in nearly 50 years of motor specialization. Trouble-free bearings and alignment, precision-balanced rotors, new and better methods of insulation, low interior temperatures and other exclusive features are engineering achievements which bring important benefits to every Uni-Shell user. Mail the coupon for an interesting 20-page booklet on the R & M Uni-Shell line and its advantages.

Uni-Shell ADVANTAGES

1—Complete interchangeability in any one frame size.

2—Trouble-free bearings and improved insulation for longer life.

3—Many interchangeable flanged end heads for vertical or horizontal mounting.

4—Adaptability to drip-proof, splash-proof and totally enclosed fan cooled construction.

5—Polyphase Induction, Direct Current and Single-Phase Induction types.

SEND FOR THIS 20 PAGE BOOKLET!

ROBBINS & MYERS, INC., Springfield, Ohio

Gentlemen: Please send me your new 20-page booklet on Uni-Shell Motors.

Name.....*Position*.....

Company.....

Street Address.....

City.....*State*.....

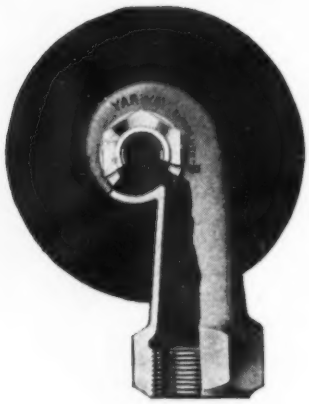
I would ☐ would not ☐ like to talk to a representative. P5

ROBBINS & MYERS • INC.

MOTOR DIVISION, SPRINGFIELD, OHIO

HOISTS & CRANES • MACHINE DRIVES • FANS • MOYNO PUMPS • FOUNDED 1878

YARWAY INVOLUTE SPRAY NOZZLES



Unique Yarway Involute design.

No internal parts or vanes to clog or erode.

Unobstructed flow gives minimum loss of head.

Finely divided spray cone provides rapid cooling.

Renewable orifices adapt nozzles for any service.

Installations total more than 5 million gallons per minute in water cooling and air conditioning service.

Made in both cast and bar-stock types. All sizes from ¼ in. to 2½ in. Write for Catalog N-616.

YARNALL-WARING COMPANY
100 Mermaid Ave. Philadelphia

The RUGGED and RELIABLE FLUSH VALVE for WARTIME BUILDINGS

THERE can be no compromise with ruggedness and reliability when operating equipment is selected for wartime buildings.

That is why, when we were designing the "V" model Watrous Flush Valve, we were so careful to select for its construction the strongest, most durable alternate materials (metals) American industry can provide. That is why Watrous proved design features were retained. And—very important—that is why we continue, through ingenious use of non-critical materials for other parts, to provide the vital operating unit — the piston — in time-proven, enduring brass construction.

This "V" model Watrous Flush Valve is saving tremendous quantities of war-essential materials. It is in compliance with limitation orders.

It is a rugged, reliable flush valve that can be counted upon to deliver the dependable, trouble-free service which is so essential in these times.

THE IMPERIAL BRASS MFG. CO.
514 South Racine Ave.
Chicago, Illinois

HERE'S SIMPLIFIED SPECIFICATION DATA on flush valves for wartime buildings

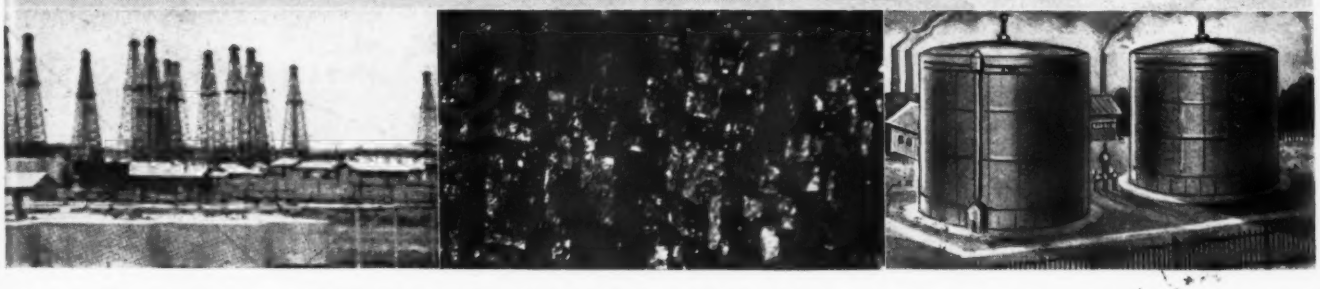
This bulletin provides:

- Information on Watrous "V" Flush Valves which are available for essential wartime construction.
- A simplified reference chart which shows the proper flush valve combinations to use to comply with War Department specifications.

Write for Bulletin 858-W.

Watrous Flush Valves

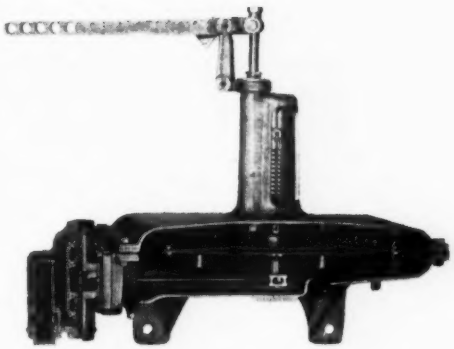
YOU'D ACTUALLY THINK THAT Mother Nature PUT MORE B.T.U's IN YOUR FUEL • • •



CASH STANDARD AUTOMATIC COMBUSTION CONTROL saves waste in fuel through correct fuel feed, proper air supply and constant over-fire draft. Therefore, with even less fuel than ordinarily used you get the greatest B. T. U. value out of your fuel and you also get more steam at less cost and with the least in attendance time.

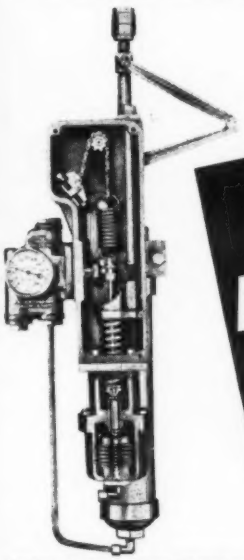
CASH STANDARD furnace draft control, air flow control, and fuel feed control does the job — the three units are available in numerous variations—combinations of the three can be made to best meet your requirements.

Bulletin No. 300 shows applications of these units for those who burn coal, oil, or gas — send for a copy.



AIR FLOW CONTROLLER

This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.

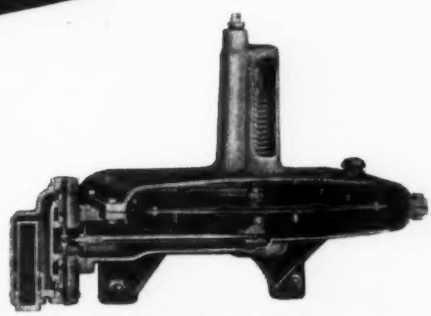


FUEL FEED CONTROLLER

This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion — hence, money saving.

CASH STANDARD AUTOMATIC COMBUSTION CONTROL SYSTEMS

CORRECT FUEL FEED
You Save COAL, OIL OR GAS
PROPER AIR SUPPLY
YOU BURN FUEL *Economically*
CONSTANT OVER-FIRE DRAFT
You Prevent UNDUE STACK LOSS



FURNACE DRAFT CONTROLLER

This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.

A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD
CONTROLS . . VALVES

A POWERful Message

FREE

TO THOSE INTERESTED IN:

- *Saving precious, rationed fuel and yet meeting steam and power requirements fully —*
- *Making a substantial reduction in the cost of steam with present equipment—*
- *Finding out the relationship of steam costs to profits—*
- *Learning how an executive can enlist the aid of the Engineer in slashing costs—*
- *Discovering the fundamental rule for securing the utmost in savings from equipment now in use—*
- *Insuring the continuous operation of boilers and avoiding possible interruption of vital steam generating facilities—*

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This 'eye-opening', money-saving treatise is NOT A SALES BOOKLET, and contains no advertising in any form. It is applicable to any make of steam generating equipment and is published in enjoyable, easy-to-read non-technical style as a service to engineers, managing executives and owners of establishments where steam generating service is used for power, heating or processing.

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COMPANY, INCORPORATED

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and we guarantee you will get ideas *from every issue* that will more than pay you for the subscription price and the time spent.

CHECK STEAM SYSTEMS NOW

Begin at least a month early this year because deliveries of replacement parts are slow, and a good overhaul now will prevent failures later. Loads are always heavier in winter, and if your plant was not warm enough last season, the increased demands next winter will surely call for adjustments.

Sarco Service includes vacuum, vapor, hot water, and radiant heating, as well as hot water service systems and all forms of steam process trapping and control. How far reaching and valuable this service can be in these times is represented by the following examples:

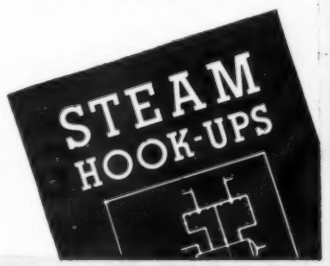
Slow heating up of vulcanizers in a tire retreading plant was due to incorrect steam traps. Sarco traps made everything O.K.and increased the output of the plant too.

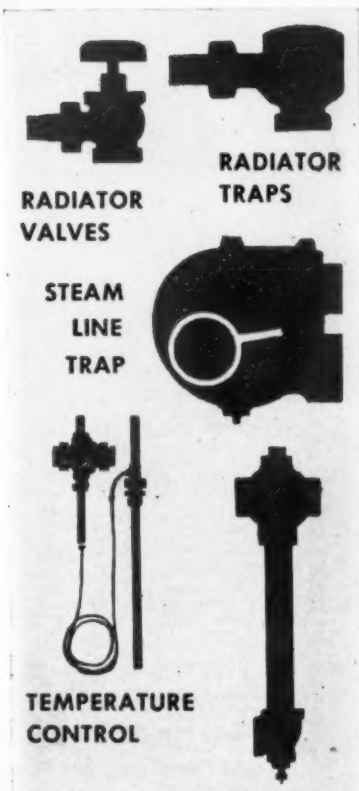
Hot water scarcity in a laundry was overcome by inserting an additional coil with a Sarco TR-2430 regulator in the heater tank.

Showers at a coal mine were too hot or too cold. A Sarco hot water blender now holds the temperature constant and saves half the fuel formerly used.

A large theater recently changed over to Sarco radiator and float traps. Savings reported: 21% of the metered steam.

The Sarco Hook-Up Book gives tables, diagrams, and recommendations which will help you improve your heating system now.



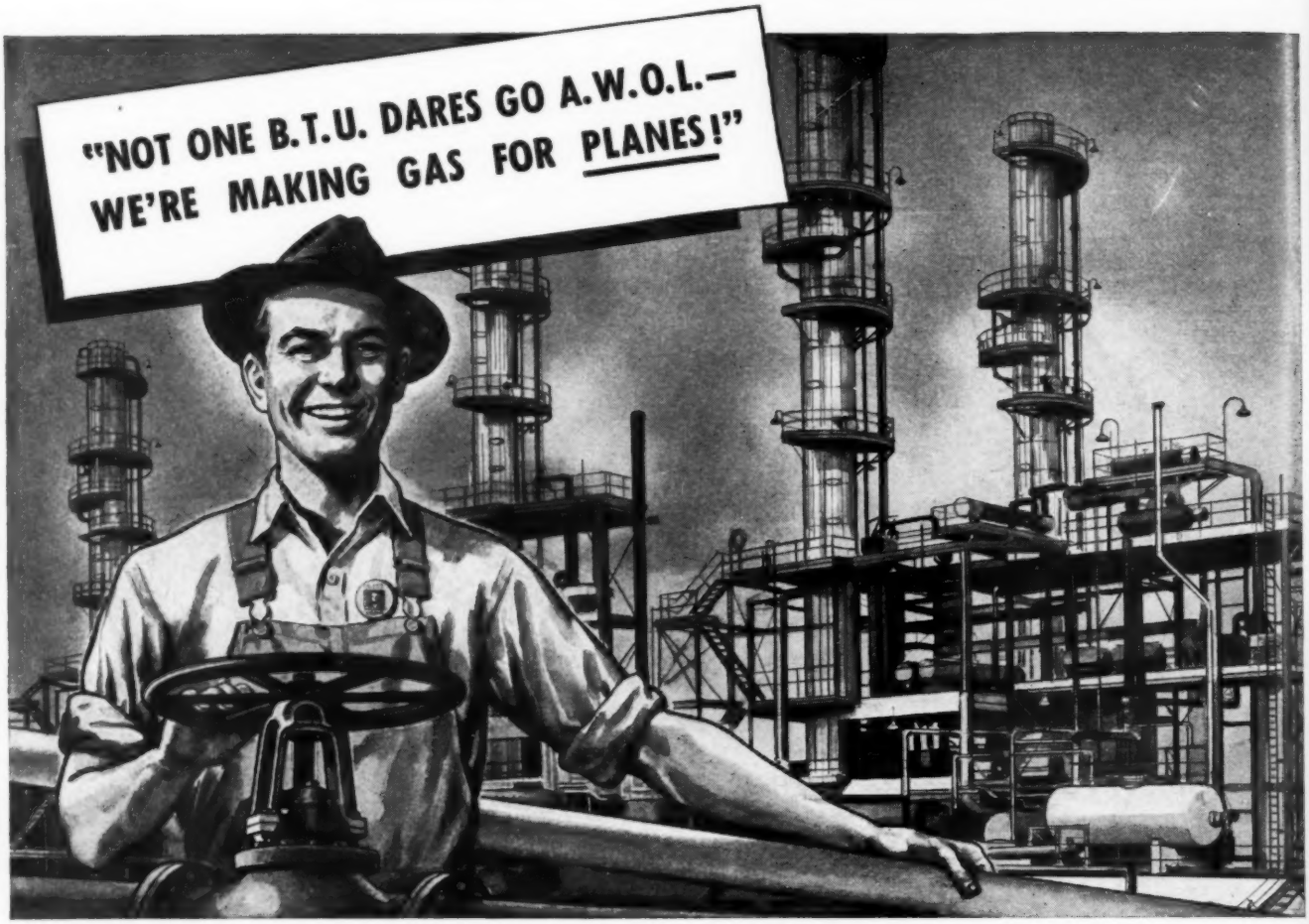


SARCO COMPANY, INC.
475 FIFTH AVENUE
NEW YORK 17, N. Y.

SARCO Saves Steam 17

REPRESENTED IN PRINCIPAL CITIES **SARCO CANADA, LTD., 85 Richmond Street, West, TORONTO, ONTARIO**

Looking ahead with Asbestos



"We're seeing that every heat unit stays right on its wartime job in *this* refinery! 100 octane aviation gasoline is precious these days. That's why you find K&M Insulation our standard safeguard against heat loss."

Many an aviation gasoline refining plant is following that sound and effective practice. K&M 85% Magnesia Insulation is in service on hot process lines, steam lines, bubble towers, heat exchangers and reboilers, preheated air ducts and other vital places.

The remarkable efficiency of K&M 85% Magnesia in preventing heat loss—and so conserving power and saving fuel—has won it a high place in the opinion of engineers everywhere, throughout wartime industry.

In fact, K&M output of heat insulation has increased to a new all-time high. And the research that goes hand-in-hand with our production will make it possible for K&M to put this war-born capacity to the best of use in the "V" years to come.

* * *

Nature made asbestos;
Keasbey & Mattison, America's asbestos pioneer, has made it serve mankind . . . since 1873

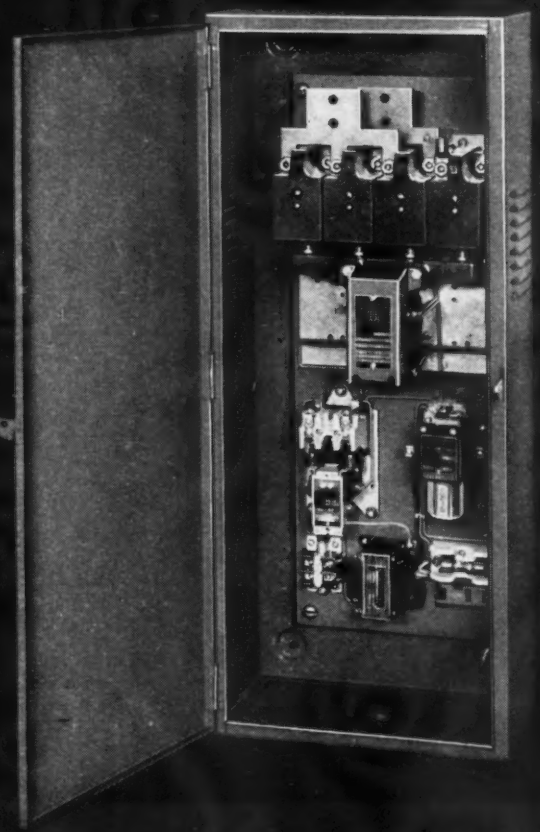
KEASBEY & MATTISON
COMPANY, AMBLER, PENNSYLVANIA

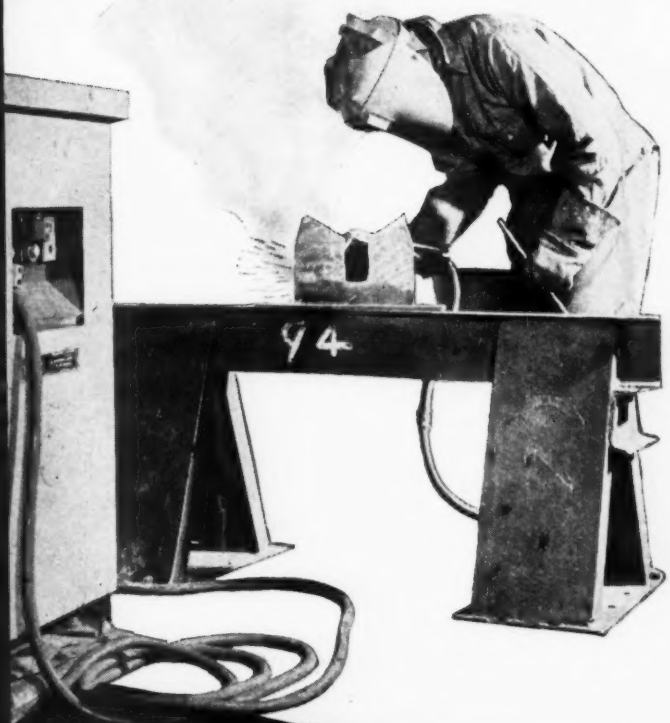
Makers of

asbestos-cement shingles and wallboards; asbestos and magnesia insulations for pipes, boilers, furnaces; asbestos textiles; asbestos electrical materials; asbestos paper and millboard; asbestos marine insulations; asbestos acoustical material; asbestos packings; asbestos corrugated sheathing and flat lumbers; asbestos-cement pipe for water mains

K&M best in asbestos

nounces
·C· ARC





HIGH open circuit voltages of A.C. arc welders (transformer type) create a definite hazard to operators. Physical contact from electrode to grounded metal surfaces (when not welding) is sometimes serious.

Square D's new class 8992 safety panels eliminate this hazard by automatically disconnecting the welder transformer after the arc is broken. The transformer is automatically reconnected the instant the operator touches the electrode to the work. Thus, the arc is struck with no delay. There is no loss in operating speed or efficiency.

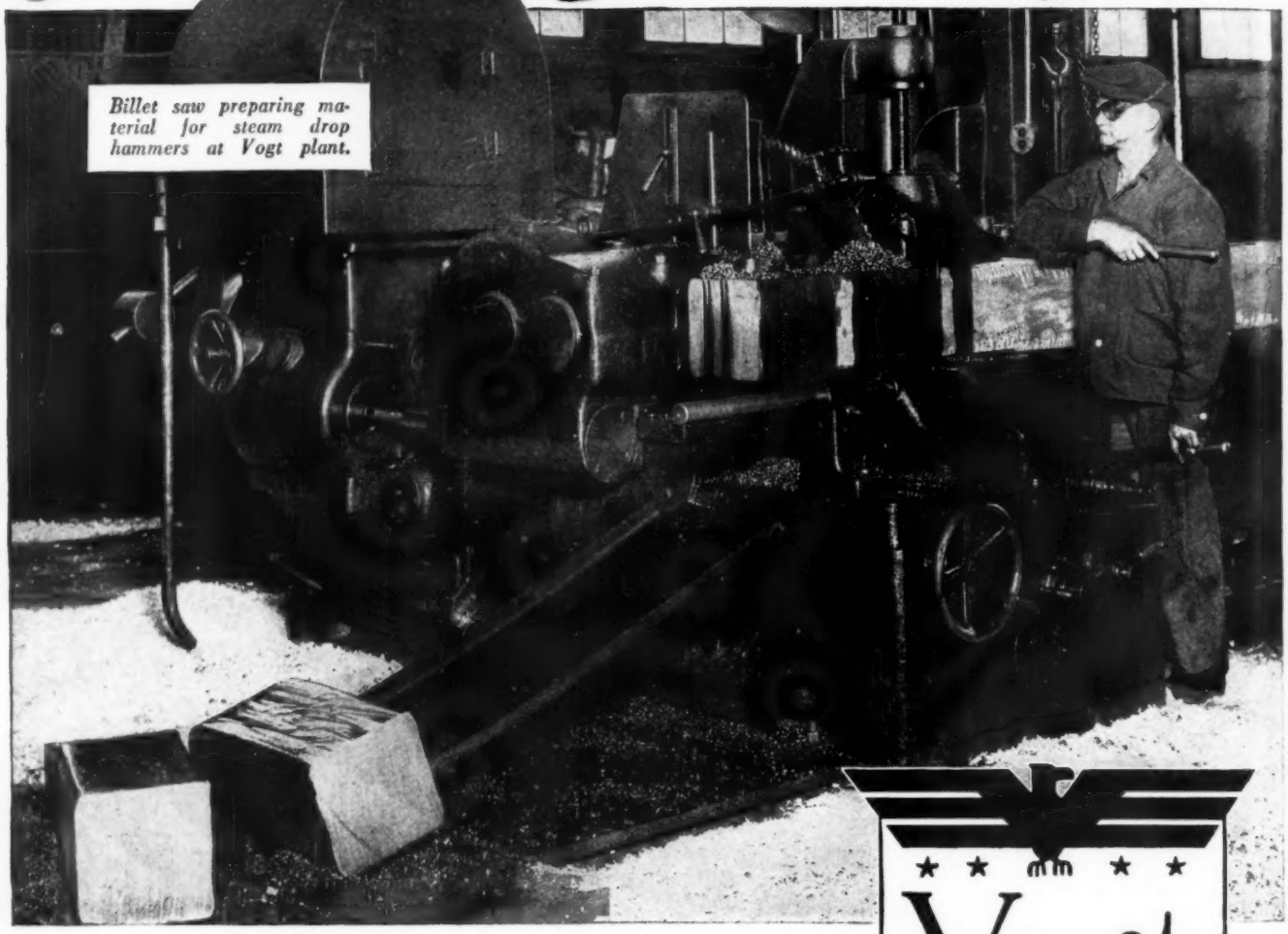
There is an economy angle, too. When Square D safety panels are used, the welding transformer primary circuit is connected to the power line only while the arc is held. Substantial saving in power is effected when a number of welders are used on a single power system and the power factor is improved.

These new safety panels can be used with any make or model of A.C. transformer type arc welder. External connections are simple and internal connections of the welder need not be disturbed.

SQUARE D COMPANY

"SAWING WOOD AND SAYING NOTHING". . . . *an old American saying*

~~Wood~~ Sawing Steel



Billet saw preparing material for steam drop hammers at Vogt plant.

and keeping WAR PRODUCTION MOVING FASTER FOR VICTORY

We're attending strictly to business here at Vogt's and quickening the tempo of War Production without fuss or feathers. Vogt Products for Power Plants, Chemical Plants, Oil Refineries, Ship Yards, Powder Plants, Synthetic Rubber Plants, etc., are being delivered in ever increasing volume to meet the requirements of the War Program FOR VICTORY!

Vogt

PRODUCTS HAVE GONE TO WAR

★ DROP FORGED STEEL VALVES FITTINGS AND FLANGES

★ OIL REFINERY AND CHEMICAL PLANT EQUIPMENT

★ WATER TUBE BOILERS

★ ICE MAKING AND REFRIGERATING MACHINERY

★ HEAT EXCHANGERS

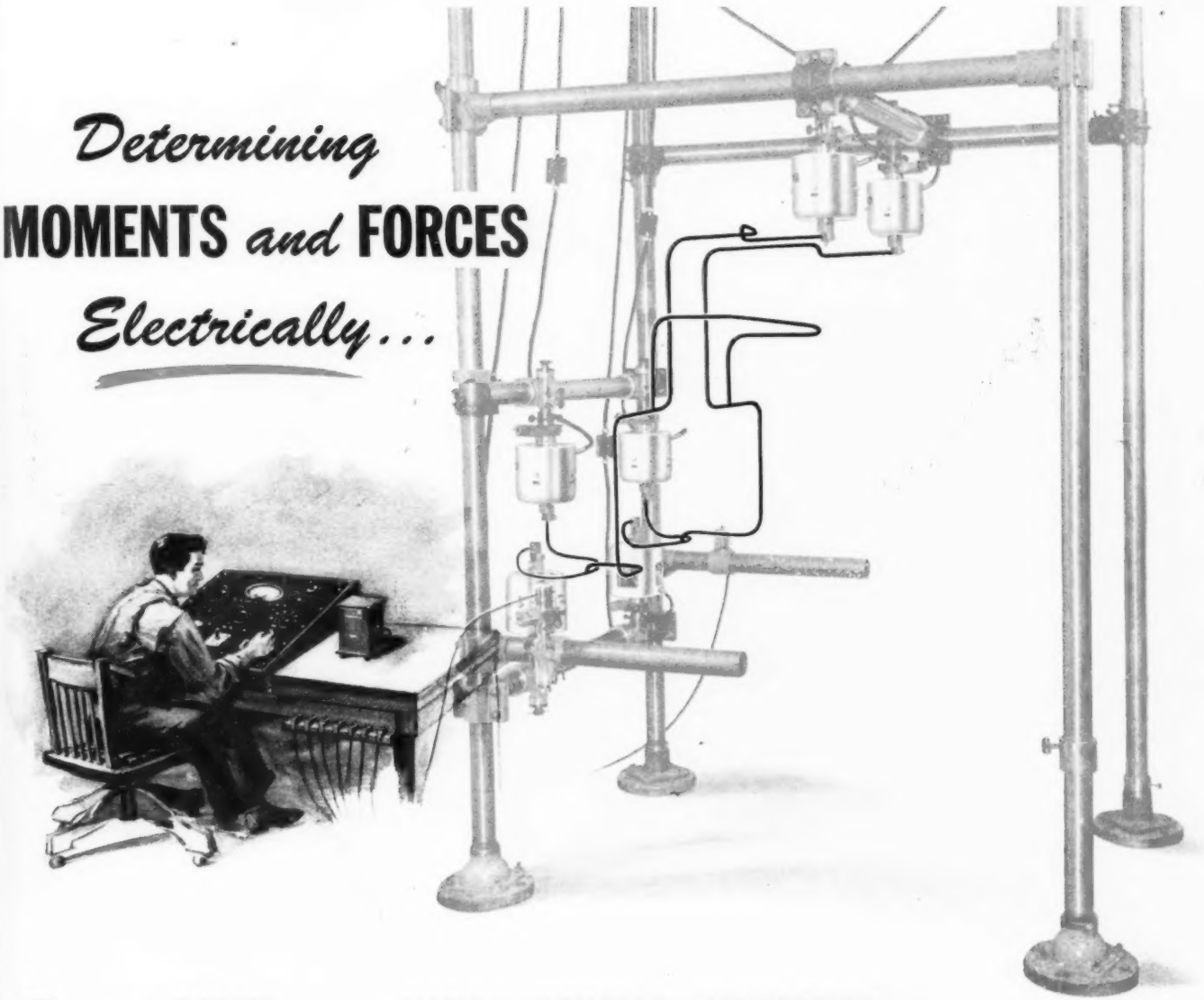
BUY WAR BONDS AND GET IN THE SCRAP

HENRY VOGT MACHINE CO.
LOUISVILLE, KY.
Branch Offices: NEW YORK PHILADELPHIA CLEVELAND CHICAGO DALLAS

Determining

MOMENTS *and* FORCES

Electrically...



Saves TIME *and* VITAL PIPING MATERIAL

The most complicated design problems of high temperature piping systems are solved by apparatus perfected and used by The M. W. Kellogg Company.

Through tests conducted on models built to scale, an exact scientific analysis of the end reactions is determined. Stresses are then computed from these reactions. The apparatus used determines the forces and moments electrically, giving faster readings and eliminating the variations present in mechanical weighing due to friction and sticking in the apparatus. Forces are weighed down to one-hundredth of a pound.

When designing complicated piping systems, the use of this scientific method secures exact results, saves time and often substantially reduces the quantity of vital piping material required.

KELLOGG

THE M. W. KELLOGG COMPANY

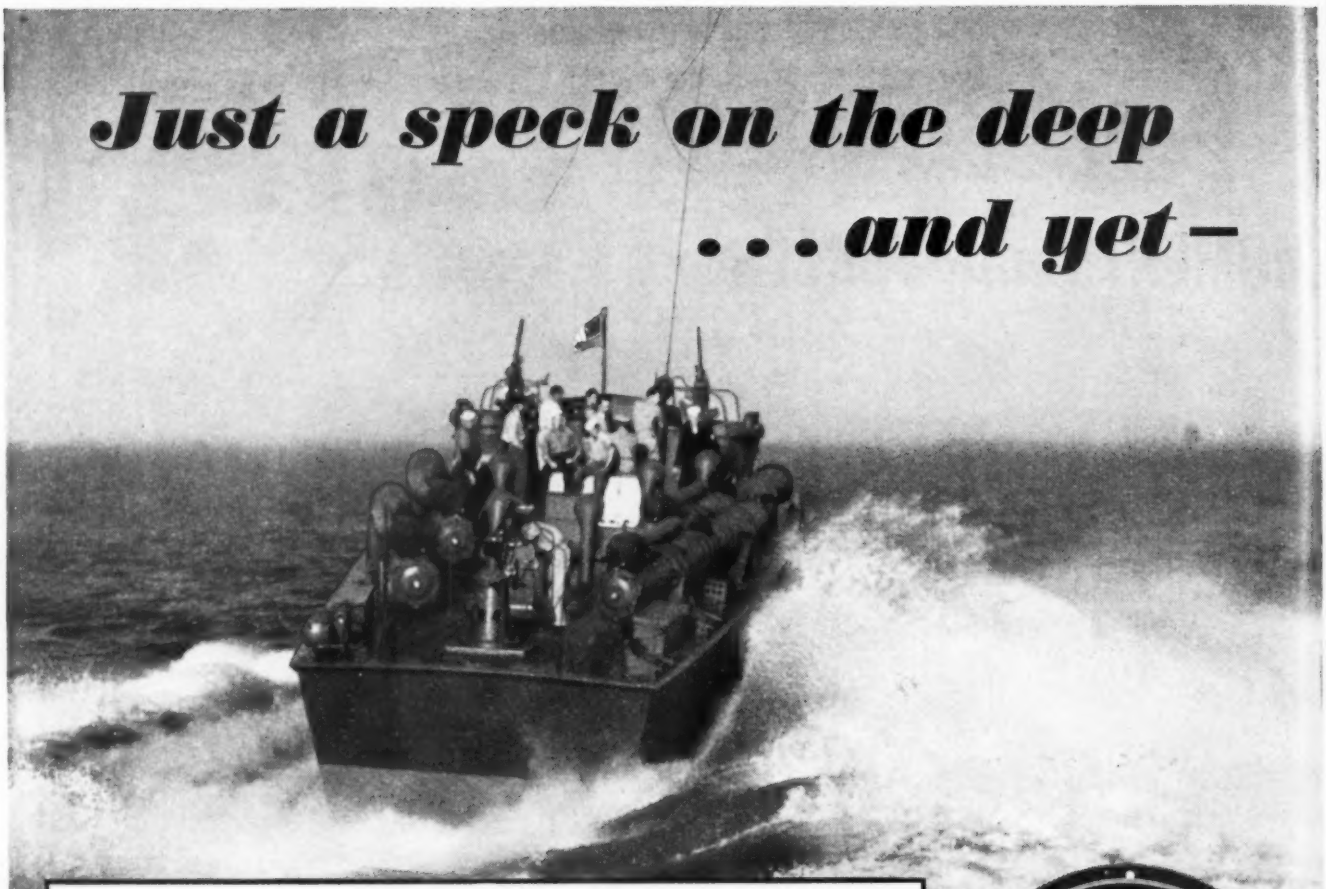
JERSEY CITY, N. J. • 225 BROADWAY, NEW YORK 7, N. Y.

Representatives:

LOS ANGELES: 609 SOUTH GRAND TULSA: PHILTOWER BLDG.

"Masterflex" Prefabricated Piping Systems • "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers Pyrolytic and Catalytic Cracking Units, Hydroforming, Reforming, Dehydrogenation, Alkylation, Desulphurization, Thermal and Catalytic Polymerization Units • JUIK Processes for Lubricating Oil Plants • Plastic Refractories. Radial Brick Chimneys.

Just a speck on the deep . . . and yet—



COMPARED to mighty first line fighting ships, these PT Boats are just specks on the ocean. But between the lines of fragmentary dispatches you read the story of their swift, deadly stings that accomplish feats far out of proportion to their size.

The Higgins PT Boat pictured above is an outstanding example of these fast, restless craft that are blazing out a trail of glory. It is one more example of the ability of U.S. industry to build units that represent functional design carried out in uncompromising quality from stem to stern.

An important part of every Higgins PT Boat is the Marsh Gauges used in the engine room and for still more vital functions that cannot be described or pictured at this time. In this application, as in hundreds of other uses reaching into every branch of the armed forces and war industries, Marsh Gauges have been selected on the basis of their long record of achievement.

Needless to say, we are doing everything within our power to build gauges and instruments that will well justify the confidence accorded them.

JAS. P. MARSH CORP., 2075 Southport Ave., Chicago 14, Ill.

The Gauge with the "RECALIBRATOR"

A gauge built to Marsh Standards is not likely to be knocked out of adjustment. But if it is, the Marsh "Recalibrator" will quickly restore its accuracy. Simply turn the "Recalibrator" screw until the pointer is at zero when not under pressure. The gauge will then be right at all points on the dial. Unlike other methods of resetting, the "Recalibrator" gets at the root of the error—re-establishes relation of bourdon tube to movement—actually re-calibrates the gauge.

MARSH GAUGES

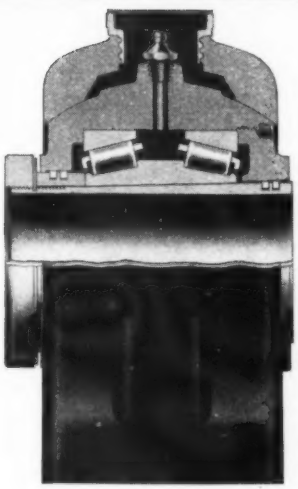
DIAL THERMOMETERS • RECORDERS • TRAPS

Timken Bearings

protect power in modern transmission equipment

Dodge-Timken Special Duty Adapter Type Pillow Block.

Beat post-victory competition now by redesigning your equipment to meet any challenge. Use Timken Bearings throughout.



Section of pillow block showing application of Timken Bearings.

There is no common or specific power transmission problem that Timken Tapered Roller Bearings cannot solve. They relieve shafts from friction and wear; protect them against radial, thrust and combined loads; and hold them in constant alignment.

Of particular value is the fact that no matter where they are applied — in line shaft hangers, pillow blocks or other power transmission units they can be sealed so thoroughly as to be immune to dust, dirt, chemical fumes, etc. While keeping injurious substances out, this effective sealing keeps lubricant in, thereby preventing contamination of the product through leakage. Does your power transmission equipment possess these modern advantages? The Timken Roller Bearing Company, Canton, Ohio.

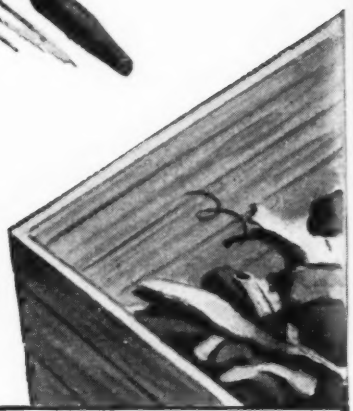
TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

DON'T SCRAP that AIRCO Tip!

Let an Airco Repair Station recondition it for you



Here's a typical result of Airco Repair. The tip at left—battered, nicked, and choked with carbon—was made good as new by skillful repairs.

Copper is one of the most critical materials. It must be conserved.

Here is one way to do it — don't discard a worn Airco welding or cutting tip until you've made certain it cannot be reclaimed. Send all your damaged Airco tips to us. Our skilled repair men will inspect them thoroughly and put them back into first-class working order . . . unless they're beyond repair.

In this way Airco can help you reclaim many tips that would otherwise end up in the scrap-box. So see that all old Airco tips are collected now and forward them to the nearest Air Reduction office.

Air Reduction

Buy United States War Bonds

General Offices: 60 EAST 42nd ST., NEW YORK

IN TEXAS: MAGNOLIA-AIRCO GAS PRODUCTS CO.

General Offices: HOUSTON, TEXAS

AIRCO

WILSON

IDLE CYLINDERS ARE PRODUCTION SLACKERS: *Keep 'em rolling for victory!*

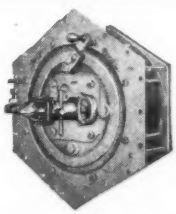
No. 4 in a series of tributes to America's War Industries

FIGHTING EAGLES RULE THE ROOST

Suddenly, with a raging roar, a pack of sleek, hungry hunters hurtle out of the sun and pounce on their favorite prey—the Luftwaffe. They're the newest American fighter planes . . . and it's no wonder Goering's "finest" hesitate to mix it up with them. Piloted by the best flyers in the world, they're as fast as lightning and they hit like thunderbolts . . . they fight like wildcats and they're as deadly as cobras.

Such planes are the result of the miracles worked by American industry in catching up with enemy fighter plane developments . . . and then passing them! The fact that they are now going out *en masse* to every fighting front is a vivid testimonial to the outstanding production achievement that has made them possible.

The fighter plane was perhaps the toughest nut to crack. But all along the line . . . tanks, ships, guns, bombers . . . there were knotty problems that were straightened out, overcome, because of the skill and the will, the brains and the brawn of American industry.



IN PLANTS OF ALL TYPES

TODD BURNERS

ARE WORKING FOR VICTORY

Wherever trouble-free, dependable combustion of liquid and gaseous fuels is a necessity . . . in war plants, in countless merchant and fighting ships . . . Todd Burners are delivering unsurpassed performance in the production of heat and power.

TODD SHIPYARDS CORPORATION

TODD COMBUSTION DIVISION

601 West 26th Street, New York City

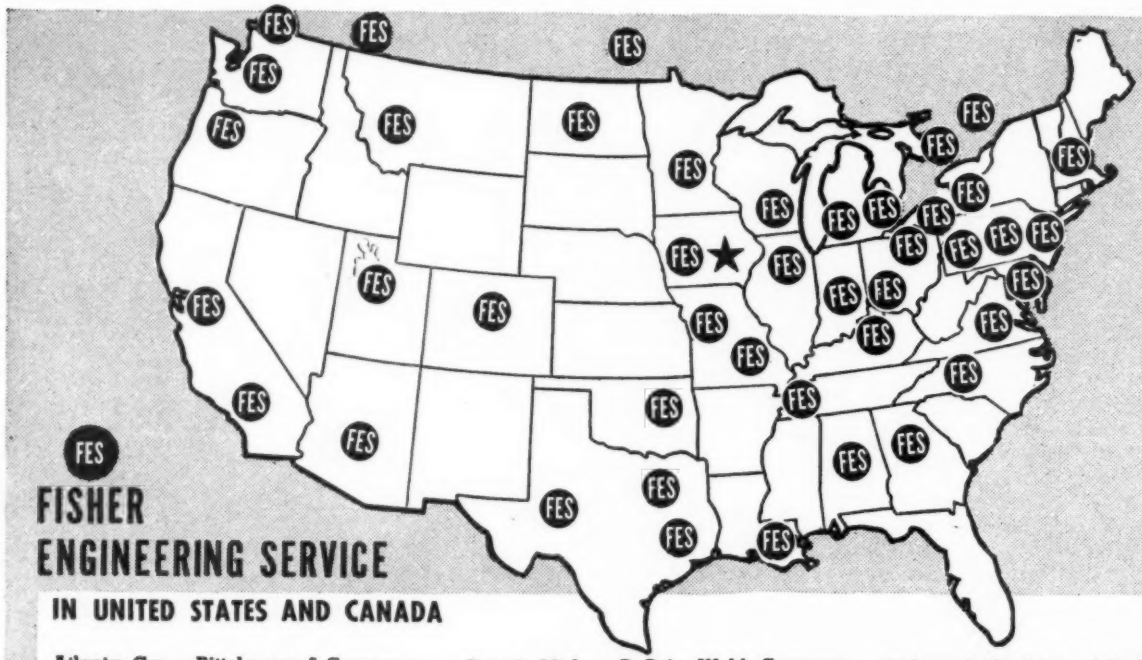
NEW YORK · MOBILE · NEW ORLEANS · GALVESTON
SEATTLE · BUENOS AIRES · LONDON

TODD BURNERS ★ ★ ON THE FIRING LINE OF AMERICA'S WAR PRODUCTION FRONT

WELL MANNED FISHER SERVICE FRONTS

Adequately Maintained To Serve Your Needs!

Fisher Governor Company's nation-wide ENGINEERING SERVICE has been maintained at full strength during this emergency because we appreciate the present need for best possible pressure and flow control, and the equally important responsibility of maintaining existing control equipment at peak efficiency. Forty-three Fisher representatives, strategically located throughout the United States and Canada have more than 150 thoroughly trained and experienced control engineers ready to serve you.



IN UNITED STATES AND CANADA

Atlanta, Ga. — Rittelmeyer & Company
Baltimore, Md. — E. A. Rhodes
Battle Creek, Mich. — DuBois-Webb Co.
Birmingham, Ala. — Eshelman & Potter
Bismarck, North Dakota — Lignite Combustion Engineering Corp.
Buffalo, N. Y. — W. J. Sommers
Butte, Montana — Sullivan Valve & Engineering Co.
Calgary, Alberta — Barber Engineering & Supply Co.
Cambridge, Mass. — L. C. Price & Co.
Charlotte, N. Carolina — Robert E. Mason
Chicago, Illinois — General Meters & Controls Co.
Cincinnati, Ohio — Harry T. Porter
Cleveland, Ohio — Tomlinson Steam Specialty Co.
Dallas, Texas — Vinson Supply Co.
Denver, Colorado — Joy and Cox, Inc.
Des Moines, Iowa — Midwest Controls Co.
Detroit, Mich. — DuBois - Webb Company
Houston, Texas — M. N. Dannenbaum Co.
Indianapolis, Indiana — Acme Engineering Agency
Los Angeles, Calif. — Fisher Governor Co.
Louisville, Kentucky — John Zimmerman
Memphis, Tennessee — C. J. Gaskell
Milwaukee, Wis. — Steam Plant Equipment Co.
Minneapolis, Minnesota — E. Floyd Bell
Montreal, Quebec — Mechanical Equipment Co.
New Orleans, La. — John H. Carter Co.
New York City, N. Y. — King & Shepherd
North Kansas City, Missouri — Uhrich Supply Co.
Odessa, Texas — Vinson Supply Co.
Philadelphia, Penn — Sheffler-Gross Co.
Phoenix, Ariz. — George S. Thompson Co.
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Toronto, Ontario — Fred Carruthers
Tulsa, Oklahoma — Vinson Supply Co.
Vancouver, B. C. — Fleck Bros. Ltd.
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Manchester, England
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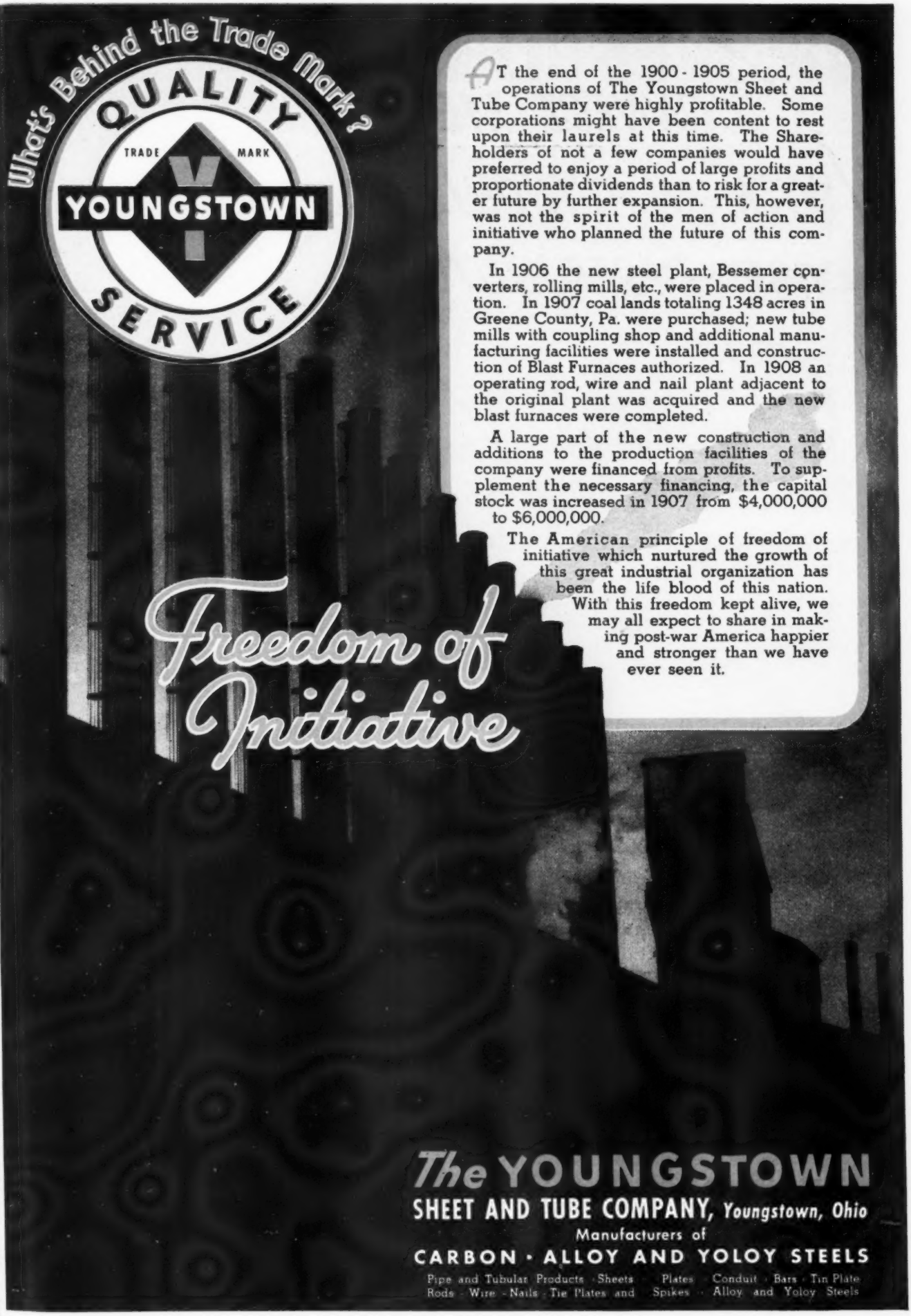
Mexico, D. F.

When you need help to put Fisher Controls into service . . . need the answer to control valve troubles . . . suggestions for possible changes in existing equipment that will effect greater control efficiency . . . recommendations for new controls to solve your particular problems . . . CALL FOR FISHER ENGINEERING SERVICE from your nearest Fisher Representative.

While the Fisher Service Fronts are still well manned — with but few men lost to the armed services, th demand on the time of these Service Engineers i extremely great. Call on them whenever you are i trouble or need help, but we ask your co-operatio in avoiding unnecessary calls. Their time is valuabl to the war program.

FISHER GOVERNOR CO
MARSHALLTOWN, IOWA


What's Behind the Trade Mark?
QUALITY
TRADE MARK
YOUNGSTOWN
SERVICE
Freedom of Initiative
AT the end of the 1900 - 1905 period, the operations of The Youngstown Sheet and Tube Company were highly profitable. Some corporations might have been content to rest upon their laurels at this time. The Shareholders of not a few companies would have preferred to enjoy a period of large profits and proportionate dividends than to risk for a greater future by further expansion. This, however, was not the spirit of the men of action and initiative who planned the future of this company.
In 1906 the new steel plant, Bessemer converters, rolling mills, etc., were placed in operation. In 1907 coal lands totaling 1348 acres in Greene County, Pa. were purchased; new tube mills with coupling shop and additional manufacturing facilities were installed and construction of Blast Furnaces authorized. In 1908 an operating rod, wire and nail plant adjacent to the original plant was acquired and the new blast furnaces were completed.
A large part of the new construction and additions to the production facilities of the company were financed from profits. To supplement the necessary financing, the capital stock was increased in 1907 from $4,000,000 to $6,000,000.
The American principle of freedom of initiative which nurtured the growth of this great industrial organization has been the life blood of this nation. With this freedom kept alive, we may all expect to share in making post-war America happier and stronger than we have ever seen it.
The YOUNGSTOWN
SHEET AND TUBE COMPANY, Youngstown, Ohio
Manufacturers of
CARBON · ALLOY AND YOLOY STEELS
Pipe and Tubular Products · Sheets · Plates · Conduit · Bars · Tin Plate
Rods · Wire · Nails · Tie Plates and Spikes · Alloy and Yoloy Steels

"CONNECT ME WITH AN AUTHORIZED SKF DISTRIBUTOR Quick!"

Obtain your MRO requirements through your Authorized SKF Distributor. He will save your time and dollars—help keep your machines producing 24 hours a day—because he knows antifriction bearings and their application. If he doesn't have the bearing you want, he can probably suggest a substitute which will do until he can get the right one. And, since he's familar with the antifriction bearing delivery situation through his frequent contacts with us, he can utilize *his* knowledge to *your* advantage . . . help *you* keep 'em rolling. 5346

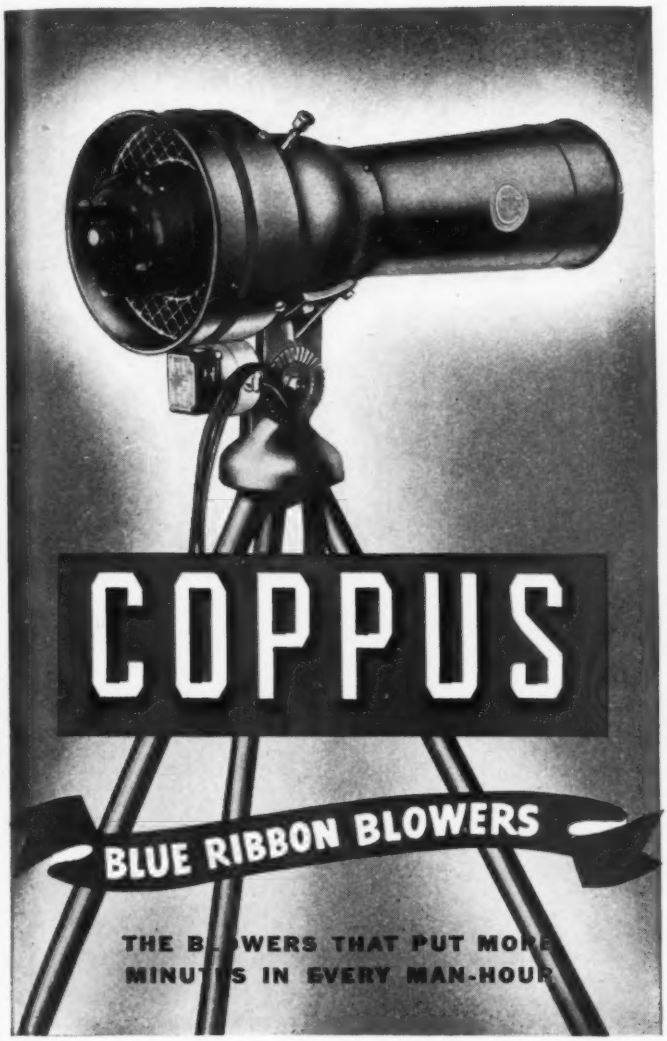
SKF

BALL AND ROLLER BEARINGS

SKF INDUSTRIES, INC., PHILA., PA.

New Strength through Air

WORKERS HAVE MORE WAR PRODUCTION "DRIVE" WITH A COPPUS BLOWER OR HEAT KILLER NEARBY



Thousands of cases prove that a man can do more work where it's cool and comfortable than where heat and bad air are continually sapping his energy.

In these cases, Coppus "Blue Ribbon" Blowers and Exhausters have earned their salt, bringing renewed energy, skill and morale to men working near furnaces . . . in tanks . . . in underground cable manholes . . . around hot processes.

Portable, adaptable for special purposes, each one built with Coppus "Blue Ribbon" precision and strength, they are putting more working minutes into every war-essential man-hour—more and better production every day!

CABLE MANHOLE AND TANK VENTILATORS — BOILER MANHOLE BLOWERS AND EXHAUSTERS — HEAT KILLERS — SHIPHOLD VENTILATORS . . . DESIGNED FOR YOUR INDUSTRY — ENGINEERED FOR YOU

MAIL THIS COUPON To Coppus Engineering Corp., 308 Park Avenue, Worcester, Mass. Sales offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in SWEET'S CATALOG.

PLEASE SEND ME INFORMATION ON SUPPLYING FRESH AIR TO MEN WORKING:

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fusilages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausting welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.
- ☐ drying of walls, sheets; etc., after treated with coating material.

NAME.....

COMPANY.....

ADDRESS.....

CITY.....

(Write here any special ventilating problem you may have.)

We have the "KNOW HOW"

Reduces Time-Out
Cuts maintainance cost
Steps up serviceability

"Buffalo" INDUCED DRAFT FANS

. . . are designed by engineers experienced in all phases of power plant operating conditions. That's why these Buffalo fans are so outstandingly *practical*. The housing construction, for example, is made up with easy-to-handle sections, bolted in place, to simplify replacement or repairs to rotor and liners . . . Cleanout doors are latched, for quick removal . . . rotors are ruggedly built to withstand erosion . . . self-aligning water-cooled bearings have conveniently renewable liners. Details like these, combined with over-all dependability of the Buffalo design, testify to "know how" so essential in the building of induced draft fans matched to *actual* power plant needs. Complete engineering data in Bulletin 3190-B.

ARMY E NAVY

BUFFALO FORGE COMPANY

488 Broadway Buffalo, N. Y.

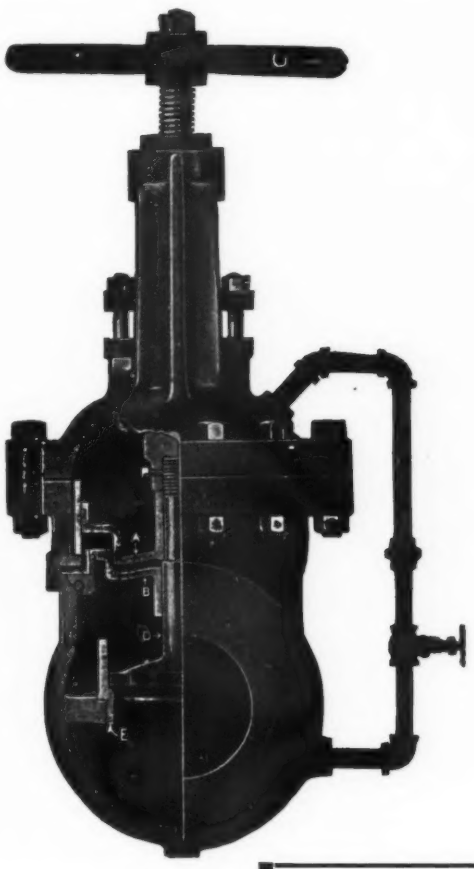
Branch Engineering Offices in Principal Cities

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo" INDUCED DRAFT FANS

GOLDEN-ANDERSON

SPECIALTY VALVES



Throttle and Emergency Stop

★

Recognized by turbine and engine manufacturers and plant operators alike as one of the most dependable valves of its kind, the G-A Throttle and Emergency Stop Valve offers positive protection against runaway turbines and engines.

OPERATING SEQUENCE: With by-pass valve opened, and trip pilot control valve reset in its closed position whenever handwheel stem is run up, the valve will automatically open to admit pressure into engine or turbine.

On overspeeding of engine or turbine the shaft governor may directly operate trip pilot control valve or limit switch, if solenoid trip pilot control is used, to open trip pilot control valve and permit engine stop valve to instantly close and stop engine or turbine.

By running down handwheel stem the valve may be closed whenever desired, and by-pass valve should be closed when the valve is to be maintained in closed position over a period of time.

The G-A Throttle and Emergency Stop Valve is available in working pressure capacities from 250 to 1500 lbs.—sizes, 2½" to 16".

Information on all G-A Specialty Valves is readily available . . . write for our catalog today!

also

Triple-acting non-return . . .
Pressure Reducing . . .
Throttle and Emergency Stop . . . check valves, etc.

GOLDEN-ANDERSON SPECIALTY VALVE CO.

FULTON BUILDING • PITTSBURGH, PA.

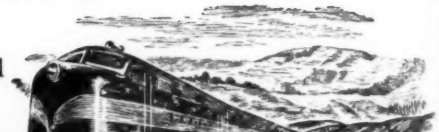
IT'S A TOUGH PROVING GROUND

THERE'S hardly a General Motors wheel that isn't whirring exclusively for war.

Yes, the heat's really on. And while we can't tell you how many engines we're building, we can say this. You can find General Motors Diesels from African deserts to Burma jungles—and on the seas between. They're in tanks, trucks, landing and patrol vessels, tractors and many other tools of war.

And although our plants have been greatly expanded, and we're making these engines at many times the prewar rate, they're still asking for more.

War's a hard taskmaster and a tough proving ground. But when the war is won, these enlarged production facilities for war's demands will mean more economical power for a better peacetime world.



New eras of transportation follow in the footsteps of war. Another new era of transportation is assured in the wake of this war. General Motors Diesel Locomotives already are establishing new standards.

GM
GENERAL MOTORS
DIESEL POWER

ENGINES.....15 to 250 H.P.....DETROIT DIESEL ENGINE DIVISION, Detroit, Mich.

ENGINES..150 to 2000 H.P...CLEVELAND DIESEL ENGINE DIVISION, Cleveland, Ohio

LOCOMOTIVES.....ELECTRO-MOTIVE DIVISION, La Grange, Ill.

OUR *check* OF THESE

7 *vital maintenance and repair needs*

LEADS TO INCREASED LIFE AND EFFICIENCY OF *any make* COOLING TOWER

1 Condition of decks or filling.

2 Condition of flumes or distributing system.

3 Analysis of water loading for optimum performance.

4 Analysis of net effect of recycling.

5 Condition of stair treads, ladder rungs and hand rails.

6 General condition of structure.

7 Condition of mechanical equipment (motors, fans, gears, flexible couplings, etc.)

To GET colder water from your present cooling tower, *regardless of make or type,* consider these *Maintenance* and *Repair* needs now. (1) Sagging decks cause channeling, prevent water break-up, thus decreasing cooling. (2) Warped flumes or a faulty distributing system result in unbalanced distribution of water through the tower, producing higher temperatures. (3) Water overloading or under-loading may decrease heat dissipation, thus lowering cooling efficiency. (4) Excessive recycling decreases the cooling capacity of incoming air. (5) Rotted or broken stair treads, ladder rungs, or hand rails cause accidents. (6) Lumber delignification may be weakening the entire tower structure. (7) Improperly adjusted mechanical equipment causes unbalanced air-water ratio, resulting in burned out motors, damaged fans and stripped gears.

These conditions may exist in *your* cooling tower.

Fluor *Maintenance* and *Repair* service corrects these conditions, prolongs the life and increases the efficiency of your cooling tower, whether atmospheric or mechanical draft type.

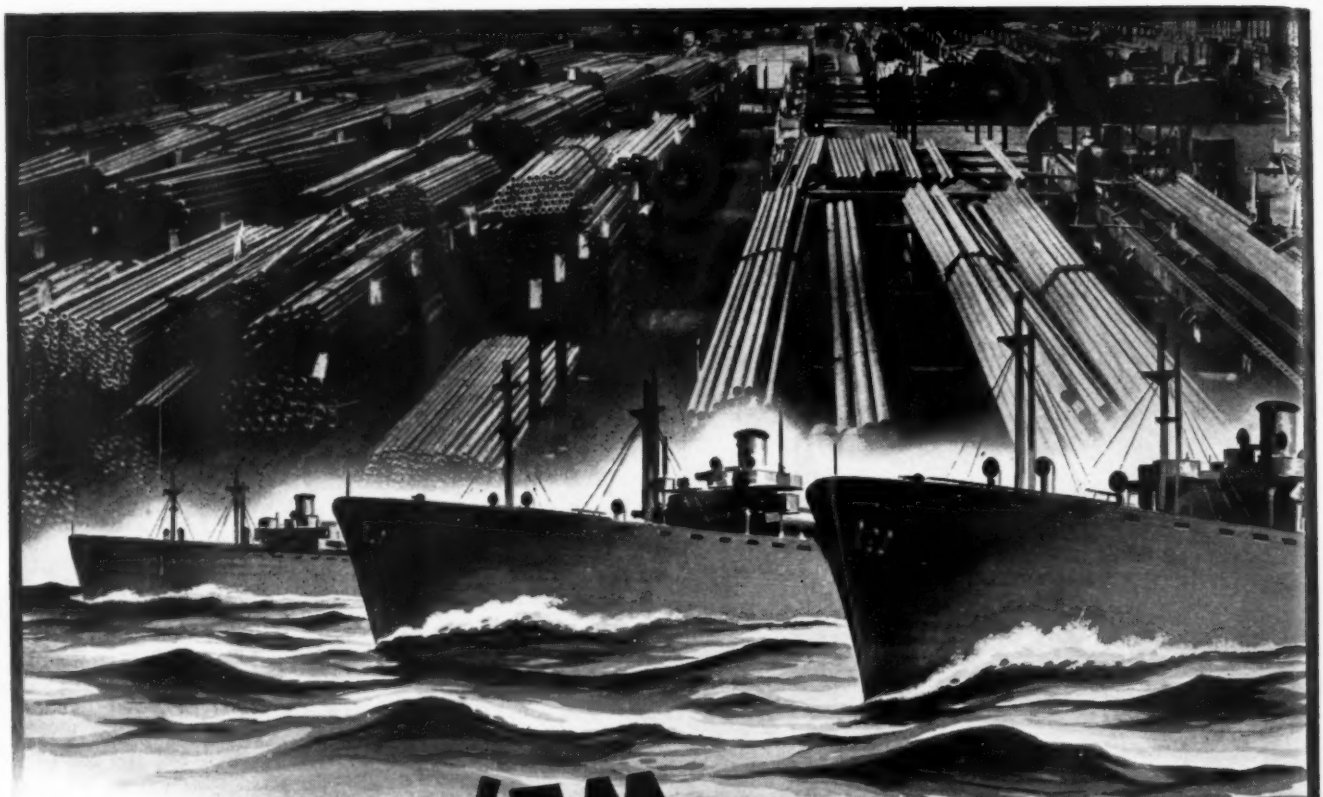
For immediate action call a Fluor man today or write or wire your nearest Fluor office.

FLUOR

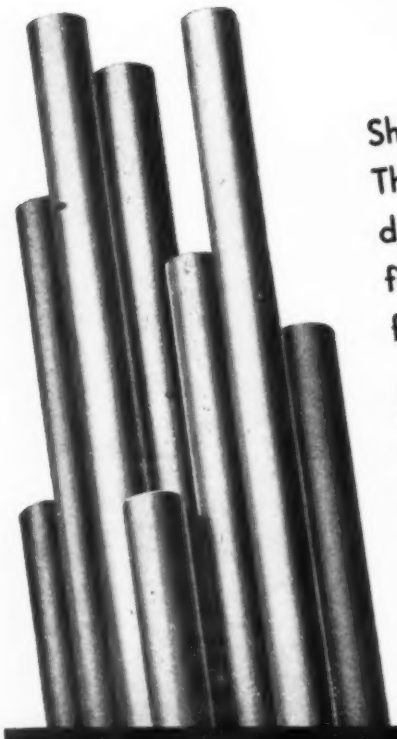
COOLING TOWER DIVISION OF THE FLUOR CORPORATION, LTD.

2500 SO. ATLANTIC BOULEVARD, LOS ANGELES 22, CALIF. • NEW YORK • PITTSBURGH • KANSAS CITY • HOUSTON

SINCE 1890



KEEP 'EM FLOATIN'



Shipping is one of the biggest war tasks this country faces. The success of our fighting arms in the far-flung battlefields depends on the reliability of the supply line—the most difficult part of which is over water. There can be no lost time for repairs due to failure of Boiler Tubes.

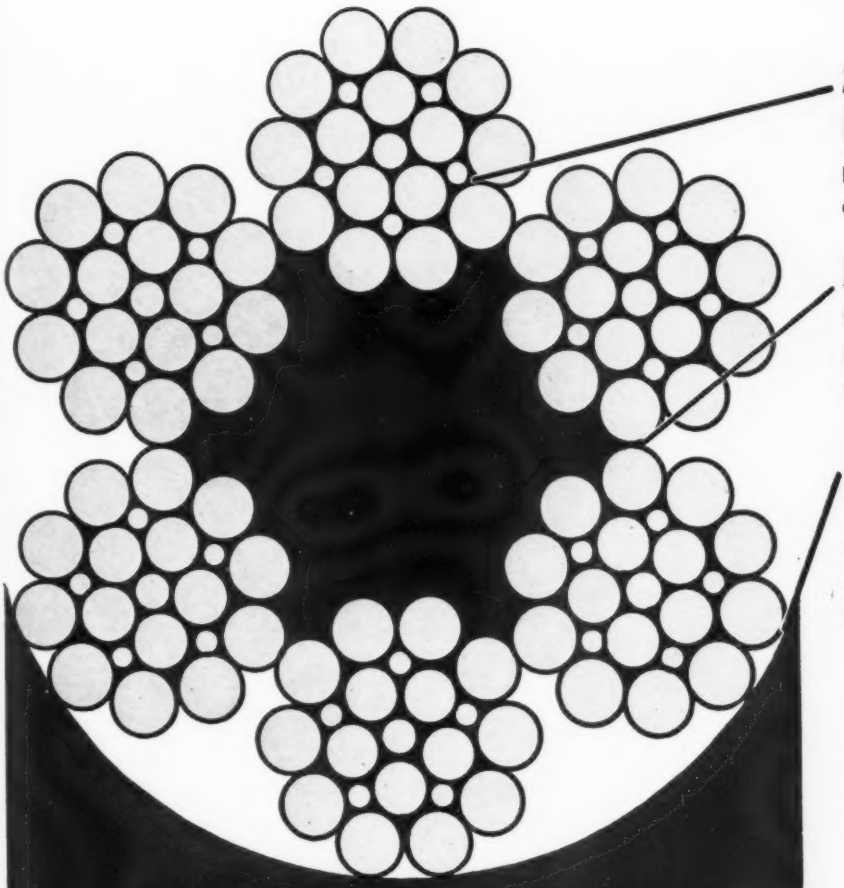
Babcock & Wilcox Boiler Tubes meet all official specifications. Each tube is individually inspected after having been subjected to a severe hydrostatic test at or above A.S.M.E. Boiler Code pressure. They are made to closest technical limits and tolerances in concentricity, uniformity of wall thickness and straightness.

TA-1253

BABCOCK & WILCOX TUBES

HOT FINISHED COLD DRAWN ALLOY STEELS CARBON STEELS

THE BABCOCK & WILCOX TUBE COMPANY, BEAVER FALLS, PA.



PREVENTS FRICTION-WEAR between the many component parts of the rope, so they can move freely as the rope works.

PREVENTS CORROSION that inevitably results when a rope runs dry or corrosive outside conditions are present.

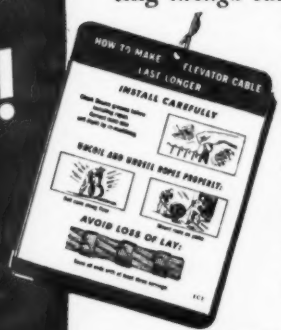
PREVENTS SHEAVE WEAR, and wear on all parts of the equipment over which the rope operates—as well as wear on the rope itself.

PROPER LUBRICATION— you owe it to your ropes AND TO YOUR COUNTRY!

IT'S NO NEWS to you that our country needs steel. Especially the superlative kind of steel that goes into Roebling *"Traction Steel"* Elevator Rope.

America has—and can produce—just so much steel. Every one of us has a share in that total. All America has a stake in your elevator ropes.

So—won't you check and *make sure* that your lubrication practice is correct? That your ropes are getting *enough* lubricant—*regularly?* It will pay you—in economy, in longer service to your building, in *better service to your country.*



ROEBLING CONSERVATION TAGS ***free on request***

JOHN A. ROEBLING'S SONS COMPANY
TRENTON, NEW JERSEY
Branches and Warehouses in Principal Cities

★ PROMPT SERVICE
★ on essential orders from warehouse
★ stocks or mill

ROEBLING

"Traction Steel"

ELEVATOR ROPE

CLEANER LUBRICATING OIL *to withstand* HEAVIER WAR-TIME LOADS

Turbines and Diesel engines working long hours under full load need all the protection that high-grade lubricants can give. But even the best oil cannot give this protection unless it is continuously kept free from all the various types of impurities with which oils inevitably become contaminated in service.

De Laval Oil Purifiers are used in outstanding power plants—a very high percentage of them—to keep oil clean, because they do a thoroughly dependable job in a most economical manner. They save oil, it's true; but, what is more important these days and every day, they save prime movers, keeping them at work for longer periods and reducing maintenance cost.

There is a De Laval Oil Purifier and system for every size and type of power plant. Full details in Bulletin No. 106. In writing, please state your particular problem so that De Laval engineers can be of real help—without obligation, of course.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 427 Randolph St., Chicago
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco
THE DE LAVAL COMPANY, Limited
Montreal Peterborough Winnipeg Vancouver

DE LAVAL *OIL PURIFIERS*

WHY MAKE

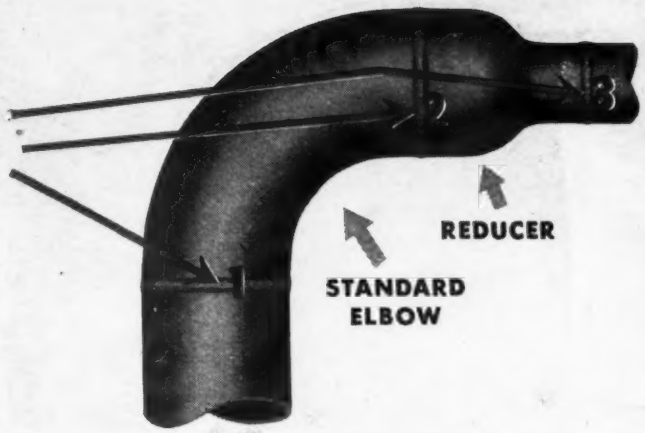
THREE Welds

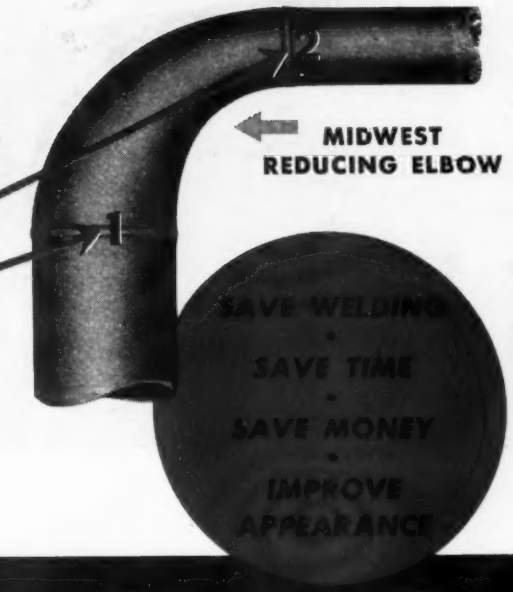
WHEN

YOU CAN GET A

Better Piping Job

WITH TWO?





In a welded pipe line when it is necessary to change both direction and pipe size, the Midwest Reducing Elbow will take the place of two welding fittings: (1) a standard elbow and (2) a reducer. The result will be the elimination of one weld, a reduction in cost of the welding fittings, a saving in erection time and expense, and improved appearance.

Midwest Reducing Elbows have all the advantages of Midwest Standard Elbows: unusual dimensional accuracy and uniformity, beneficial effect of working the metal in compression, stress relieving, etc. They have the same center-to-end dimensions as standard elbows with which they are interchangeable.

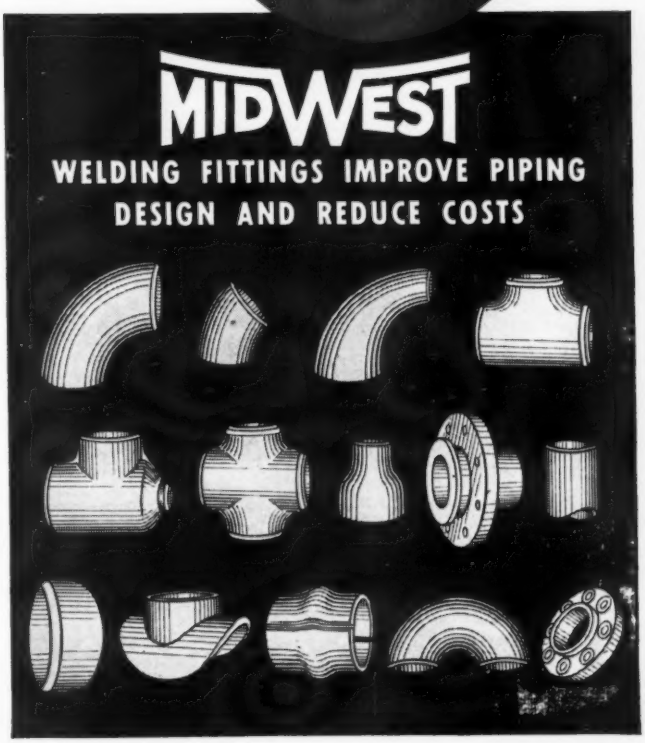
The Reducing Elbow is one of the many Midwest developments that have added greatly to the design improvement and the time- and money-saving possibilities of welded piping systems. See Bulletin WF-41 for complete information.

MIDWEST PIPING & SUPPLY COMPANY, Inc.

Main Office: 1450 South Second St., St. Louis, Mo.

Plants: St. Louis, Passaic (N.J.) and Los Angeles

Sales Offices: Chicago—645 Marquette Bldg. • Houston—229 Shell Bldg.
Los Angeles—520 Anderson Street • Tulsa—533 Mayo Bldg.
New York—(Eastern Division) 30 Church Street



Clipper pilots have extra eyes

To assist in making night-time landings at the far-flung marine and land bases of Pan American World Airways, every Clipper captain has several "extra eyes"... radio, navigation, wing lights — and a piercing, dependable beacon light.

The big Diesel generators that pump power to these street lamps of the sky are the Clipper stations' nerve centers. They supply electricity for work shops, kitchens and living quarters — as well as illumination. They must be kept going at top efficiency night and day. To make sure they do, Pan American lubricates its Diesels with RPM DELO.

RPM DELO frequently doubles the time between Diesel overhauls. It ends ring-sticking, protects bearings against corrosion, cuts ring and liner wear to the thinnest minimum. No other lubricating oil gives your Diesels the protection they get from RPM DELO— because no other compounded oil combines its ring-cleaning, non-corrosive and anti-oxidant properties.

ORDER RPM DELO FOR YOUR DIESELS

RPM DELO is marketed under these names:

RPM DELO
Caltex RPM DELO
Kyso RPM DELO
Signal RPM DELO
Sohio RPM DELO
Imperial-RPM DELO
CONCENTRATE

Ask your Diesel engine manufacturer or distributor for the RPM DELO supplier in your vicinity

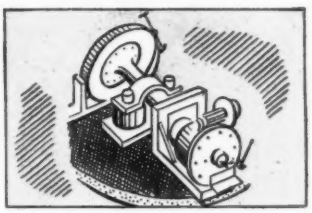
STANDARD OIL COMPANY OF CALIFORNIA

THIS INTER-PLANETARY DRIVE

HAS REVOLUTIONIZED ALL STANDARDS OF STOKER PERFORMANCE

1. WEAR-OUT TEST

A Winkler Transmission was run *continuously* for one full year, *carrying a Prony break load of 600% over normal!* The running time, considering the overload, represented over 30 years of normal service. Upon inspection by engineers, not a single part showed noticeable signs of wear.



2. OBSTRUCTION TEST

A railroad spike was inserted to block the feed screw. An automatic counter recorded the number of times the Safety Release disengaged and then restarted the motor in an attempt to crush the spike. *The Transmission was permitted to disengage and reset itself more than 100,000 times!* Inspection by engineers showed no damage of any nature.

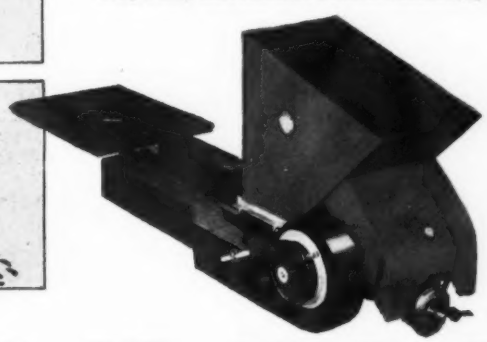
3. LOW GRADE FUEL TEST

A 30%, three-inch mix of stones, bricks and concrete scraps was added to the poorest grades of mine-run coal, mostly slack and dust. Due to the Transmission and the Release, this mixture was crushed and fed to the fire without attention or damage.

Today's fuel oil emergency and man-power shortage place a premium on failure-proof, industrial stokers. Therefore, showing you how the feed screw of a Winkler Stoker will chew a 2 x 4 into matchwood—*or grind a rock to fragments*—is not just a showman's trick! It is a power demonstration of importance to men responsible for the conversion of oil to coal.

A stoker is no better than its driving mechanism—*and on this point the Winkler Stoker invites the most critical comparison!* The well-known mechanical advantages of *internal planetary gearing* are ingeniously employed to provide a transmission of extraordinary power. Power enough to crush 90% of the obstructions in the coal which ordinarily cause a service disruption!

If the obstruction should prove uncrushable, the Winkler Locked Screw Safety Release goes into action—*disengaging and resetting* the Transmission until the object is removed. No shear pins to replace—no overload switches to reset—*the Winkler Stoker has the only fully automatic Transmission, guaranteed for three years.*



FREE BOOKLET

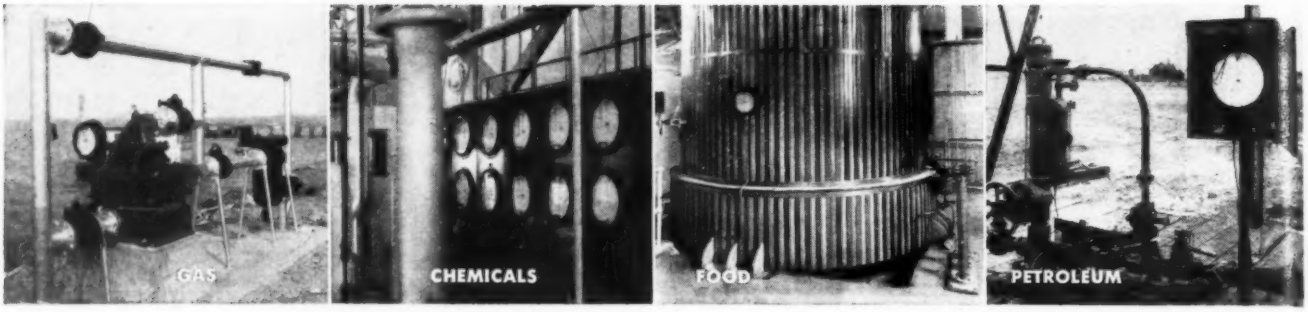
The Winkler Engineering Department has published an interesting brochure on the mechanics of inter-planetary gearing as applied to Winkler Stokers. Your request for a copy will be promptly honored.

PHONE OR WRITE!
Call your nearest Winkler dealer for full information... or write direct to the factory.

WINKLER

fully automatic **STOKERS**

U. S. MACHINE CORPORATION • LEBANON, INDIANA



For Super-Pressures or Zephyr-Light Forces...

ACCURATE MEASUREMENTS, ACCURATELY RECORDED!

There's sound engineering reason why every properly-installed Foxboro Pressute Instrument gives dependable results throughout years of maintenance-free service. It has been specifically designed for its working conditions . . . to withstand continual fluctuations, corrosion, or other tough conditions of its particular job.

In more than 35 years of creative development, Foxboro has perfected a line of pressure instruments containing types exactly suited to each industrial service. For closest accuracy in *measurement* of pressures, there's a special measuring element for each range from full vacuum to 10,000 pounds. For special corrosive conditions, various special alloys are employed. And, to insure close fidelity in *recording* these measurements, Foxboro recorder movements have been individually engineered to reduce lost motion, friction and inertia to a negligible minimum!

No matter whether your jobs involve "zephyr-light" pressures, or pressures up to 10,000 pounds, you'll get

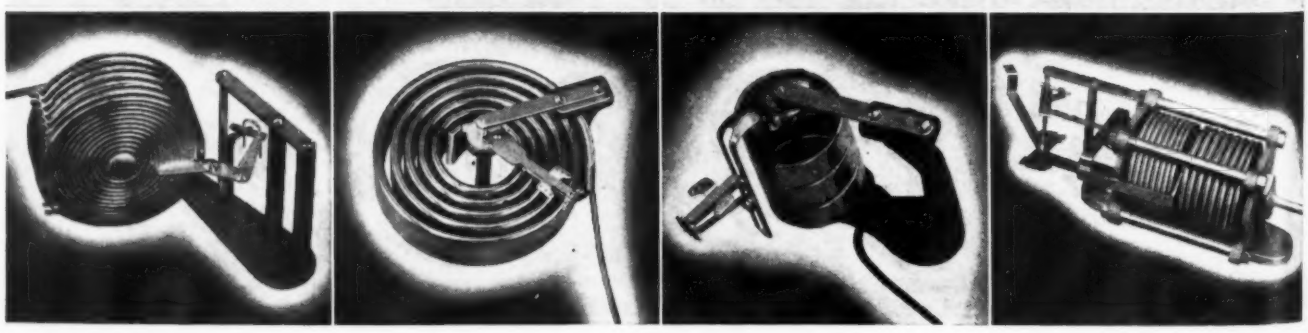
continuously accurate results from Foxboro Pressure Recorders, Controllers and Indicators.

Write for complete Catalog 22A. The Foxboro Company, 68 Neponset Ave., Foxboro, Mass., U. S. A.

Pressure Recorders by FOXBORO

Reg. U. S. Pat. Off.

DIAPHRAGM ELEMENT	SPIRAL ELEMENT	HELICAL ELEMENT	HYDRON ELEMENT
Pressures from 1" of water to 5 lbs.	Pressures from 5 lbs. to 50 lbs.	Pressures from 50 lbs. to 10,000 lbs.	Pressures up to 50 lbs. absolute



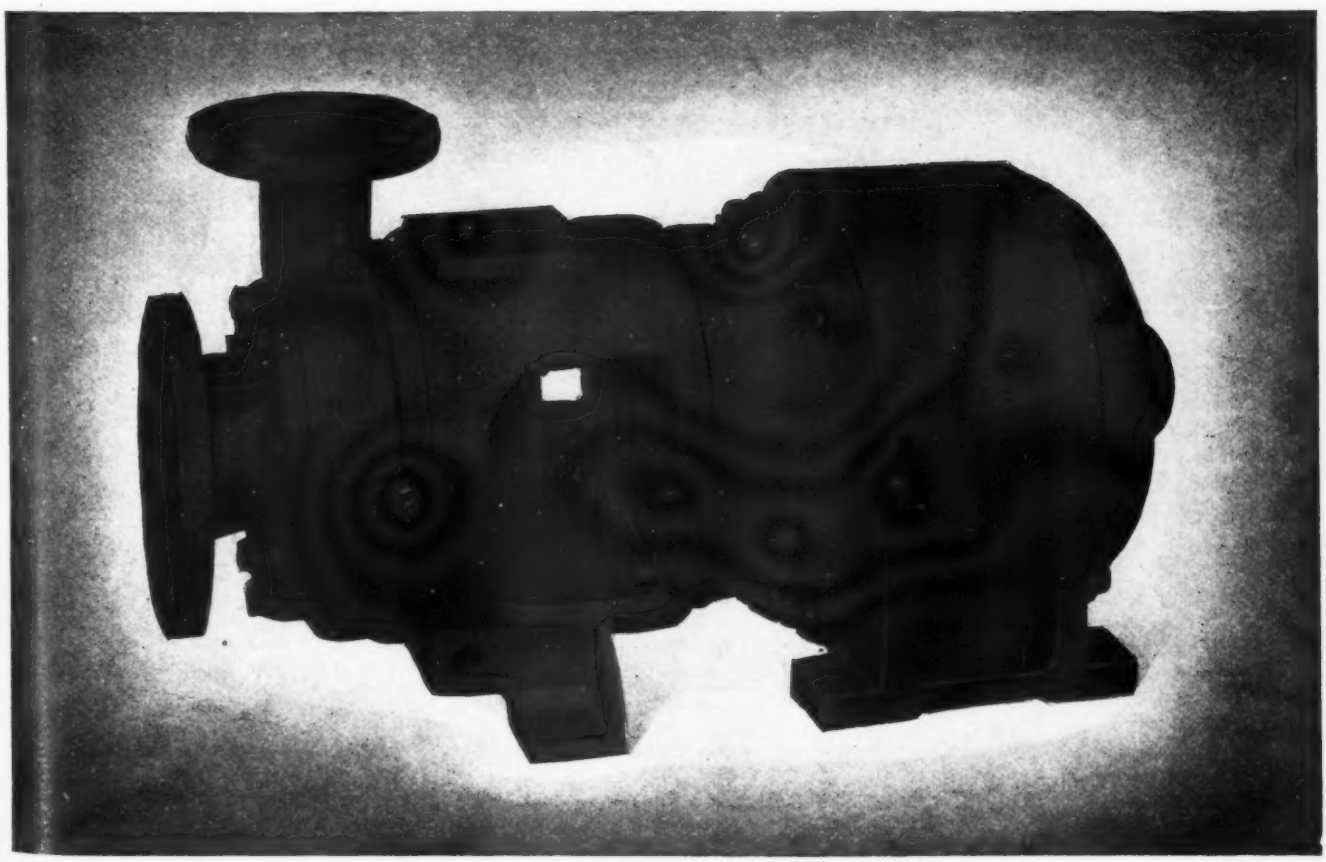
JACK OF ALL TRADES
and master of them too

The Motorpump is truly a jack-of-all-trades, and master of them too, because of its compactness, sturdiness, efficiency and adaptability. Wherever liquids are being handled you will find Motorpumps—from refineries to ships and from the tropics to the arctic. • Motorpumps are available in a wide range of sizes and all can be installed easily without costly special foundations. Capacities range up to 1800 gpm and discharge heads up to 500 ft. • Thousands of them in all sorts of services are speeding the transport of liquids—liquids that keep machines on the job; liquids needed in processes; liquid foods; liquids that must be removed to keep mines operating, to speed construction work; etc. Ingersoll-Rand Company, Cameron Pump Division, 11 Broadway, New York, N. Y.

Ingersoll-Rand

CENTRIFUGAL PUMPS • CONDENSERS • OIL AND GAS ENGINES • ROCK DRILLS • AIR TOOLS • TURBO-BLOWERS • COMPRESSORS

9-298



WeldELLS have everything ★

"For MY KIND of work, give me WeldELLS"

THIS maintenance job is a tough spot in anybody's language. But the piping end of it would be a bed of roses if all the lines were welded with WeldELLS!*

Give me a good man with a torch, and a stock of WeldELLS, and I'll show you how to lick those quick changes that come up these days, too. WeldELLS have everything it takes to speed up the job and cut the costs—tangents that make them easy to line up; quarter-markings to guide the work; clean bevels and lands that make welding both good and fast. You don't have to grope for the proper size either, because the size and weight is marked right there on the fitting.

When the job is done with WeldELLS it's done for keeps. There's no tinkering or trouble shooting. For my kind of work, give me WeldELLS!

★ No other fittings for pipe welding combine these features found in WeldELLS:

- **Seamless** — greater strength and uniformity.
- **Tangents** — keep weld away from zone of highest stress — simplify lining up.
- **Precision quarter-marked ends** — simplify layout and help insure accuracy.
- **Selective reinforcement** — provides uniform strength.
- **Permanent and complete identification marking** — saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum** — assures full strength and long life.
- **Machine tool beveled ends** — provide best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World** — insures complete service and undivided responsibility.

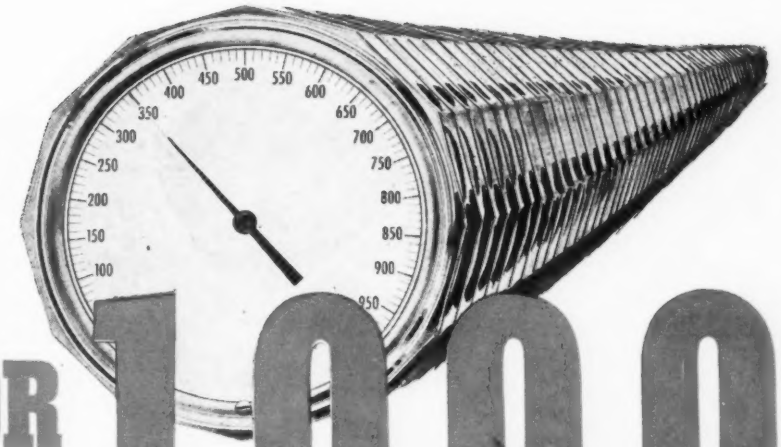
TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P. O. Box 485

WeldELLS are just one of many Taylor Forge products that are vital to war and victory. An example is huge rolled steel rings—an important part of U.S. tanks now in action.

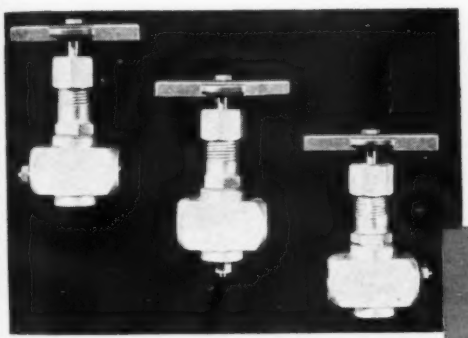
NEW YORK OFFICE: 50 CHURCH ST. • PHILADELPHIA OFFICE: BROAD ST. STATION BUILDING

* WeldELLS and many other Taylor Forge products are produced in Byers Genuine Wrought Iron.

CHECK 1 OR 1000 OR MORE GAUGES

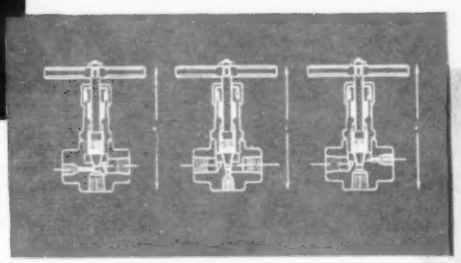


WITHOUT BREAKING EXISTING LINE CONNECTIONS



THE GROVE *Triport* VALVE

Designed for permanent installation on each service gauge connection, the newly perfected Grove Combination Test and Shut-off Valve, used in conjunction with the Grove Comparator, effects further time savings in checking gauges. It avoids the necessity of breaking existing line connections.



By reducing the line displacement between the service gauge and the Comparator, the Grove Triport Valve permits a greatly increased number of gauges to be checked on each charge of the rechargeable pressure cylinders. Through the use of this valve as many as 1000 gauges can be checked on a single pressure charge, depending on pressure ranges. For full details write today for Bulletin No. 300.

THE GROVE *Pneumatic Gauge* COMPARATOR

GROVE *Pneumatic Gauge* COMPARATOR

GROVE SIMPLICITY ACCURACY SAFETY

GROVE REGULATOR COMPANY

1197 67TH STREET, OAKLAND, CALIFORNIA

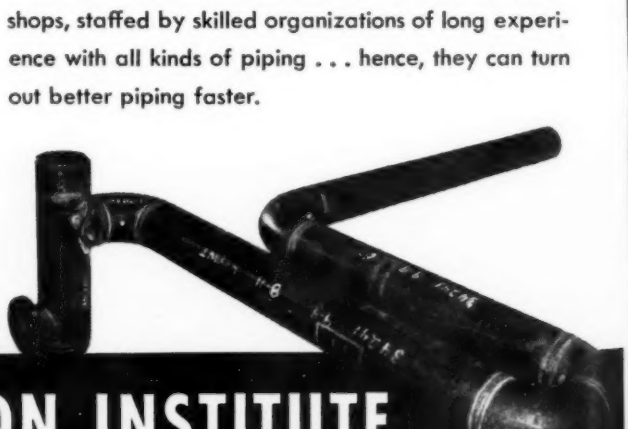
BRANCH OFFICES: 5644 NAVIGATION BLVD., HOUSTON, TEXAS • 30 ROCKEFELLER PLAZA, NEW YORK CITY, N. Y.

A FAST START IS A BIG ADVANTAGE IN *Piping Too*

The runner who gets a quick start has a big advantage over the slow starter. Often the quick start is the difference between winning and losing the race.

A quick start is an important advantage in piping too. Give a qualified pipe fabricator an early start and you will obtain substantial benefits. If scarce materials are involved, an early order may avoid serious delay in delivery. If the piping plans are started at the time equipment is ordered, the qualified pipe fabricator has an opportunity to study the plans . . . which frequently results in suggestions that save time and money and improve the piping design.

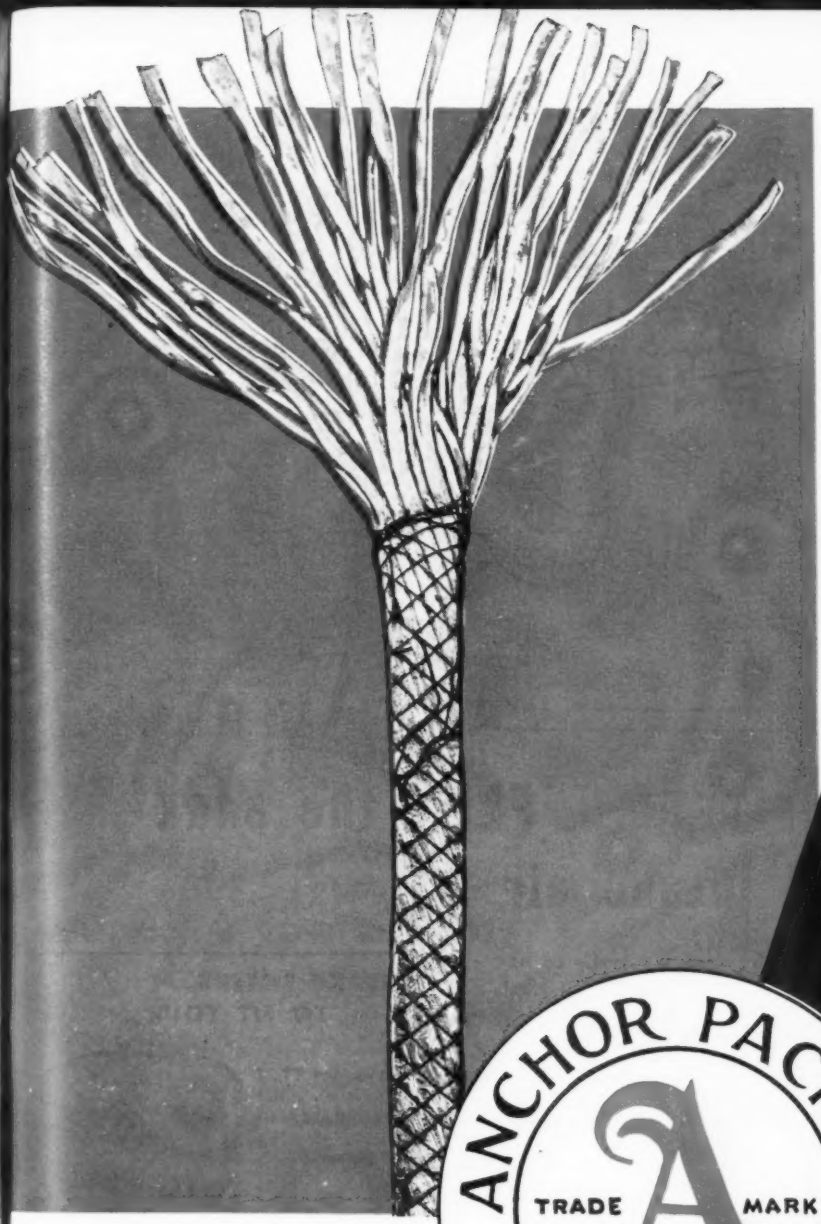
Qualified pipe fabricators have well-equipped shops, staffed by skilled organizations of long experience with all kinds of piping . . . hence, they can turn out better piping faster.



THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

1108 CLARK BUILDING • PITTSBURGH, PA.



ROXBORO

METALLIC PACKING ASBESTOS CORE IN RING, SPIRAL AND COIL FORM

No. 851 is an unusually efficient metallic packing of low friction alloy formed around individually wrapped strands of lubricated asbestos cushions. Being soft and pliable, it readily adjusts itself to its running position without flaking at the point of wear, and is so constructed to insure a metallic contact at all times. Installed with the ease of fabric packing yet gives far longer wear.

ROXBORO—No. 851 will not score and is suitable for use on temperatures as high as 450° F. and may be used on high and low pressures in any service where a Babbitt metal is suitable.

THE ANCHOR PACKING CO. TRADE A MARK

THE ANCHOR PACKING COMPANY

MANUFACTURERS—DISTRIBUTORS

METALLIC & FIBROUS PACKINGS FOR EVERY PURPOSE

GENERAL OFFICES

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Milwaukee, Wisconsin	4417 West North Avenue
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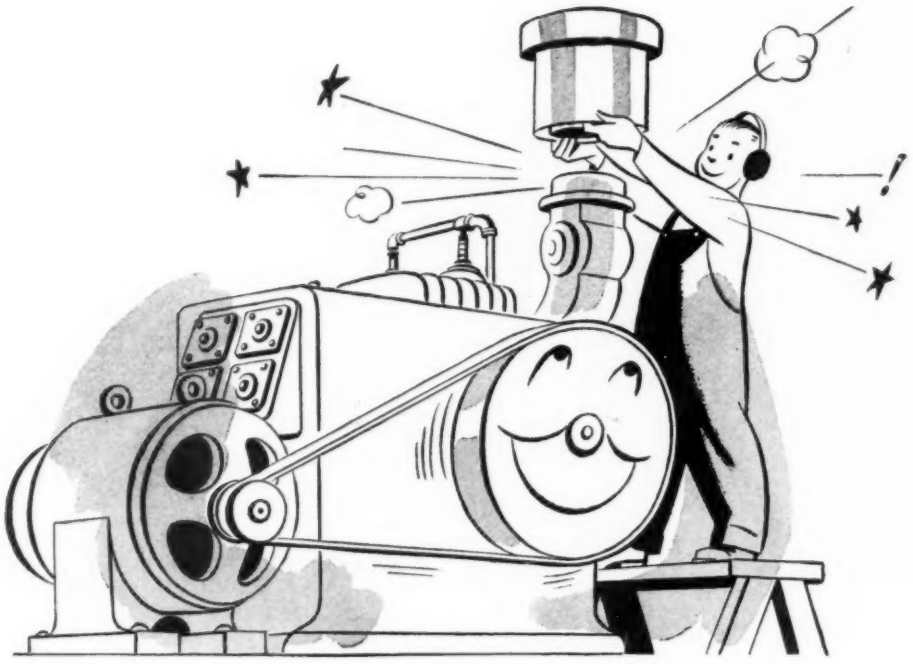


MUZZLES the BITE, MUFFLES the BARK of intake air

Not many engineers let grit-laden air chew up the polished insides of their engines and compressors . . . if they know it.

But the bark of intake air can be as hard on workers as its unfiltered "bite" is on machines.

So—why not *muzzle* the bite and *muffle* the bark with a single device?

Where it is desirable to combine the advantages of Air-Maze filters with silencing devices, use Air-Maze filter-silencers. The silencing chamber is designed in proportion to the filter, and consequently to the equipment on which it is installed.

Air-Maze filter-silencers are available in either oil-bath or oil-coated types, featuring the patented Air-Maze crimped, wire mesh media. These permanent, nondeteriorating filters can be kept at their original high efficiency for years, even under severe dust or lint conditions.

Standard Air-Maze filter-silencers cover all common engine and compressor needs. Special sizes can be built to meet any requirements.

For specific recommendations, write, giving full particulars of installation.

Large, oil-bath type Air-Maze filter-silencer. Incoming air flow is reversed and scrubbed by oil before entering the filter media. Silencing chamber is lower portion of unit.

One of over 3,000 types

INTAKE FILTERS TO FIT YOUR NEEDS

OIL-BATH TYPE traps dust most efficiently, due to double filtering action.

MULTIMAZE TYPE —highly efficient, viscous coated element for heavy duty.

UNIMAZE TYPE— used both as spark arrester and intake filter. Has less dust capacity than Multimaze type.

Write for catalog

AIR-MAZE CORPORATION • CLEVELAND, OHIO

AIR-MAZE

SPECIALISTS IN AIR FILTRATION

Less Training!

RELIANCE V★S DRIVE

AN ALL-ELECTRIC ADJUSTABLE-SPEED DRIVE FOR A-C CIRCUITS

SPEED RANGES TO FIT THE WORK SIZES 1 TO 30 HP.

This illustrates an application, typical of many, in which Reliance V★S Drive reduces operator training time through the ease, convenience and flexibility of all-electric power control. This simplicity of machine control not only permits greater latitude in the selection of personnel but helps bring new operators up to peak production quicker. For further advantages of Reliance V★S Drive and its varied applications in many industries, send for Bulletin 311.

CALL IN A RELIANCE APPLICATION ENGINEER from our nearest office to work with you on applying electric motor-drive to speed up production, improve quality and reduce costs. These are the things that count today — *and will count tomorrow, too.*

RELIANCE A-C D-C MOTORS

RELIANCE ELECTRIC & ENGINEERING COMPANY

1088 Ivanhoe Road • Cleveland, Ohio

BIRMINGHAM • BOSTON • BUFFALO • CHICAGO • CINCINNATI • DETROIT • GREENVILLE, S. C. HOUSTON, TEXAS • LOS ANGELES • MINNEAPOLIS • NEW YORK • PHILADELPHIA • PITTSBURGH PORTLAND, ORE. • ST. LOUIS • SAN FRANCISCO • SYRACUSE, N. Y. AND OTHER PRINCIPAL CITIES

WRITE FOR A COPY OF BULLETIN CO-5

WING

ADAPTABLE TO ALL TYPES OF BOILERS

Hand-Fired, Stoker-Fired, Oil-Fired, Gas-Fired, Bagasse-Fired, Pulverized Coal-Fired, etc.

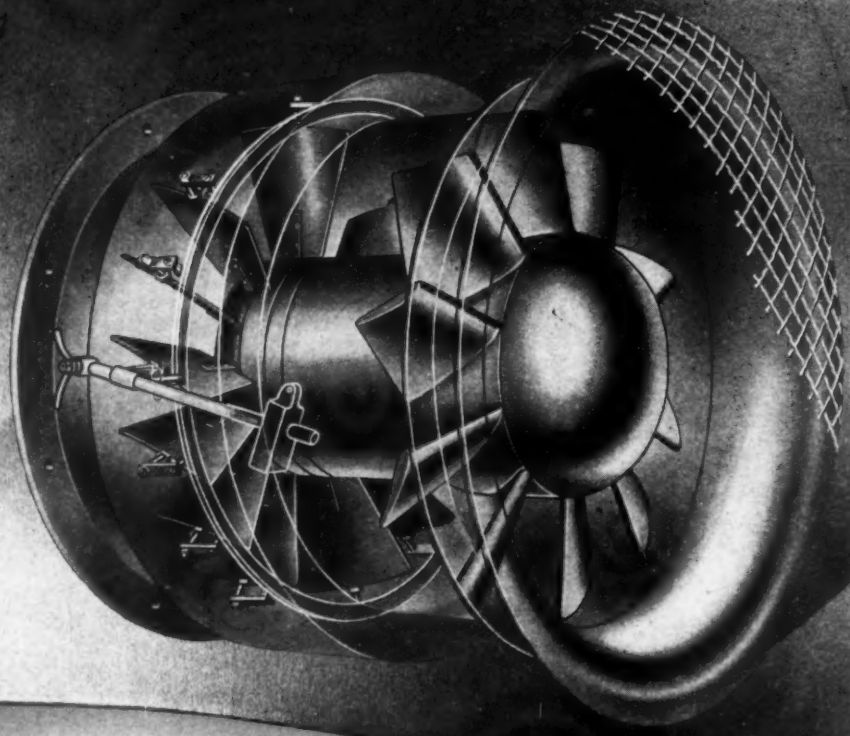
WING SINGLE-STAGE BLOWER

TYPE EMD

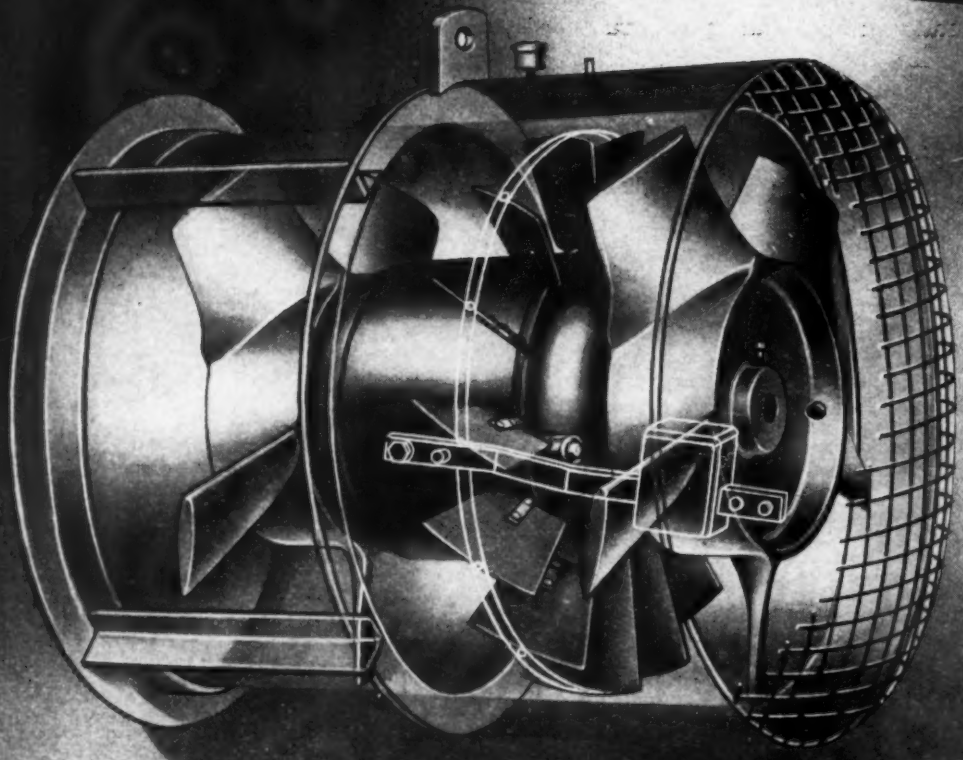
CAPACITY REGULATION BY BUILT-IN VOLUME CONTROL

(Wing Voltrol-Vanes)

Internal radial dampers are actuated by an external balanced lever. This can be adjusted manually or connected to any standard combustion control regulation. It is precise in action and a reduction of volume is accompanied by a reduction of horsepower over a wide range.



WING AXIAL FLOW BLOWERS with VOLTROL-VANES



CHARACTERISTICS:

HIGH EFFICIENCY
Total Head Efficiencies Run 90% and Higher

NON-OVERLOADING HORSE-POWER CHARACTERISTICS

WING TWO-STAGE BLOWER

TYPE COM

COMPACTNESS
Economy of Space and Weight

BASE OF CONTROL

QUIET OPERATION

14th St. at 7th Ave., New York, N. Y. **L. J. Wing Mfg. Co.** Factories, Newark, N. J.

HELPING BOOST THE BOMBER

BIRTH RATE

How Cardox Systems Protect War Industries

- Timed discharges, as needed, through built-in piping systems . . . supplied instantly from a single storage unit holding tons (if required) of liquid Cardox CO_2.
- Mass discharge of Cardox CO_2 "knocks out" fire, by . . .
- Reducing oxygen content of the atmosphere below the concentration necessary for combustion, and . .
- Cooling combustibles and fire zone below ignition temperature . . .
- Extinguishing fire quickly and completely *without* damage from extinguishing medium.

CARDOX—CO_2 Systems with Enhanced Fire Extinguishing Performance

A. Uniformity of CO_2 characteristics.

B. Extinguishing medium with uniformly greater cooling effect.

C. Accurate projection of CO_2 through greater distances.

D. Timed discharges, as needed, through built-in piping systems . . . supplied quickly from a single tank holding tons of liquid Cardox CO_2.

• Before a Flying Fortress . . . or any other war plane . . . takes to the air, an amazing number and variety of parts must be fabricated, assembled and tested. Should fire occur anywhere along the line . . . throwing production schedules out of time . . . the bomber birth rate is likely to take a dangerous nose dive.

There are Allied planes making it tough for the Axis today that wouldn't be in the air except for the fire extinguishing performance provided by Cardox Fire Extinguishing Systems.

Engineered applications of Cardox Systems are guarding against delay of vital war industry—for example, in plants producing:

Airplanes, Aviation Engines, Aviation Carburetors, Airplane Parts, Engine Parts, Plastics, Rubber Products, Processed Fabric, Tanks, Tank Engines, Cold Strip Steel, Armor Plate, Forgings, Solvents, Motor Fuel, Electric Power.

Cardox Fire Extinguishing Systems give a maximum of protection . . . guarding *time* as well as equipment . . . by providing (1) immediate extinguishment by cold, inert carbon dioxide, which quickly smothers and "cools out" large or small fires; (2) elimination of damage by the extinguishing medium means machines and materials are usually back in production quickly.

Today Cardox is concentrating its engineering and manufacturing facilities on two vital phases of America's current emergency: (1) The design and manufacture of Cardox Fire Extinguishing Systems needed by a wide range of war industries to maintain and increase the birth rate of battle equipment; (2) working with industry on plans to increase the efficiency of fire protection both today and after the war.

If you would like more information, write on your company letterhead for Bulletin P-8.

CARDOX CORPORATION
BELL BUILDING • CHICAGO, ILLINOIS

District Offices in **New York • Washington Detroit • Cleveland • Atlanta • Pittsburgh San Francisco • Los Angeles • Seattle**

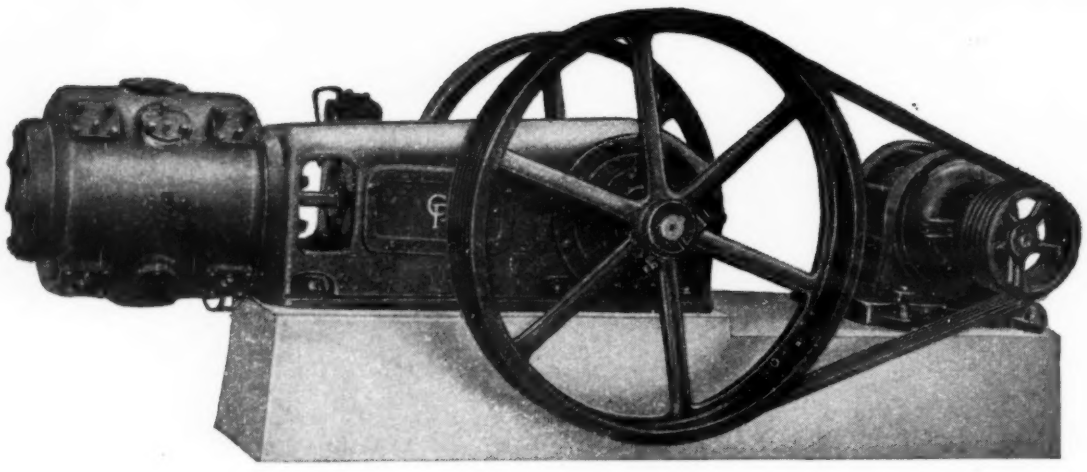
MASS DISCHARGE OF CO_2 · ENHANCED COOLING EFFECT · CENTRAL STORAGE UNIT · AMPLE CO_2 RESERVE · ENGINEERED SYSTEMS · MANUAL OR AUTOMATIC CONTROL

CARDOX

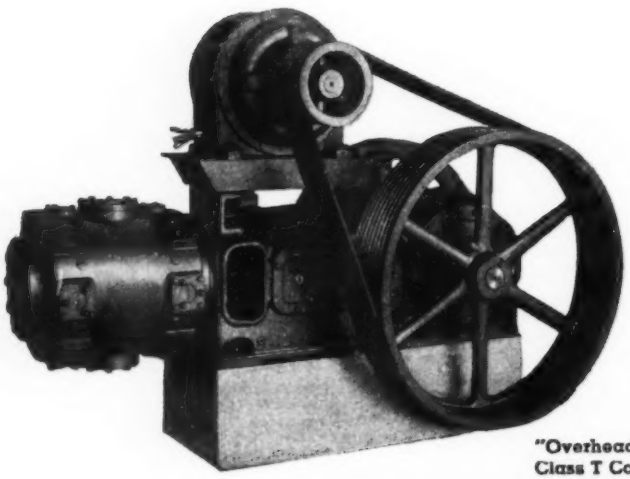
NON-DAMAGING FIRE EXTINGUISHING SYSTEMS

A Heavy Duty COMPRESSOR

FOR TWENTY-FOUR HOUR SERVICE



Available For Quick Deliveries



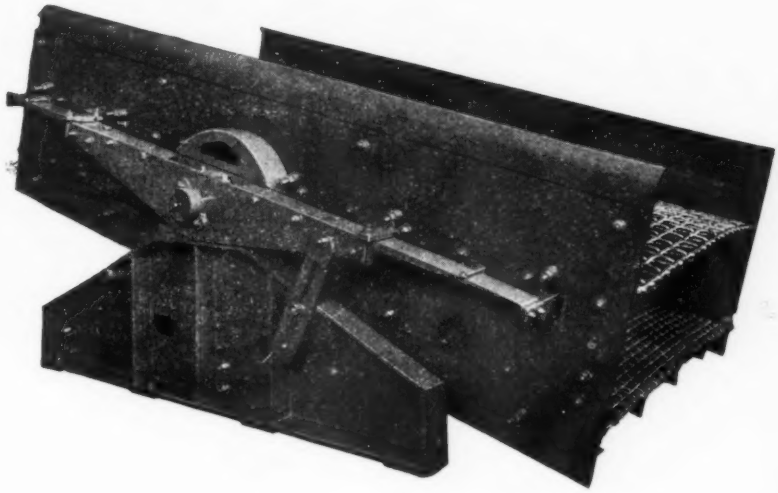
"Overhead "V" belt drive ideally adapts Class T Compressor for use where space is limited."

Chicago Pneumatic Class T Compressors are built in a wide range of sizes . . . 15 to 125 h.p. . . . in single or multi-stage designs . . . for pressures up to 5,000 pounds . . . "V" belt, synchronous motor or steam drive. Also available with "Oilless" cylinder for use where compressed air must be free of oil. Send for Bulletin 728.

★★★★★★★★★
PNEUMATIC TOOLS
ELECTRIC TOOLS
(Hicycle...Universal)
ROCK DRILLS

CHICAGO PNEUMATIC
TOOL COMPANY
General Offices: 8 East 44th Street, New York 17, N. Y.

★★★★★★★★★
AIR COMPRESSORS
VACUUM PUMPS
DIESEL ENGINES
AVIATION ACCESSORIES



ROBINS VIBRATING SCREENS ARE ENGINEERED

. . . for the specific job they are to perform

The efficiency, the economy, the durability you get from your vibrating screens depend to a great extent upon their ability to perform the precise functions and to handle the specific materials encountered in your plant.

Robins Vibrating Screens are engineered individually for each job . . . given the correct speed, stroke, pitch and number of decks required for the kind, weight, mass, flow and quantity of bulk material to be sized and handled.

The screens, themselves, represent outstanding examples of engineered designing. Take the Robins *Gyrex*, for example. It employs the single-shaft, circle-throw, positive stroke principle . . . a principle which, by the way, was originated by Robins, and on which we still hold basic patents. Added to the benefits and advantages of this principle are features which further promote efficiency, further increase productivity, further reduce maintenance expense . . . features found in no other makes or kinds of vibrating screens. Among them are:

1. Ability to adjust the angle of the live frame without requiring any change of the supports.
2. A stabilizing arrangement of the springs which relieves the eccentric bearings from the impact of thrust loads.
3. A heavy, anvil-type floor-mounted cast base which absorbs impact forces eliminating the need for costly foundations or supports.
4. Triply-protected cloth arrangement. The cloth is supported over rubber-cushioned members; it is maintained under spring tension; it has a slight transverse arch. Whipping and crystalization are eliminated; failure from these causes is prevented. The arch further tends to distribute material across the full width of the screening surface—all of which is serviceable since there are no clamps, no straps, no bars to blank-off this screening area.

Robins *Gyrex* Vibrating Screens are intended for heavy duty sizing and scalping. For fine sizing, the Robins *Vibrex* has a high-speed, unbalanced vibrator. For horizontal installations and dewatering, the Robins *Eliptex* has an elliptical throw—to convey oversize material. Fully illustrated and descriptive bulletins sent on request. Kindly address your request to Dept. P.

ROBINS *makes:* BELT CONVEYORS • COAL AND ORE BRIDGES • BUCKET ELEVATORS • CAR AND BARGE HAULS • CAR DUMPERS • CAR RETARDERS • CASTINGS • CHUTES • CONVEYOR IDLERS AND PULLEYS • CRUSHERS • FEEDERS • FOUNDRY SHAKEOUTS • GATES • GEARS • GRAB BUCKETS • PIVOTED BUCKET CONVEYORS • VIBRATING SCREENS • SCREEN CLOTH • SELF-UNLOADING BOAT MECHANISMS • SKIP HOISTS • STORAGE AND RECLAIMING MACHINES AND SYSTEMS • TAKEUPS • LOADING AND UNLOADING TOWERS • TRIPPERS • WEIGH LARRIES • WINCHES • WINDLASSES

FOR MATERIAL AID IN MATERIALS HANDLING . . . . . It's ROBINS

ENGINEERS • MANUFACTURERS • ERECTORS

ROBINS CONVEYORS
INCORPORATED
(ROBINS CONVEYING BELT CO.)
PASSAIC • NEW JERSEY

MATERIALS HANDLING MACHINERY

FOR EMERGENCY GAS SUPPLY

A PRITCHARD designed *Stand-By* fuel system will eliminate the costly results of a forced shutdown due to failure of regular gas supply. Fuel can be delivered by rail tank car or truck at any time, and stored for an emergency or critical demand.

Propane-air possesses same heating qualities as natural gas and can be substituted in the industrial system without burner adjustments. Complete or partial changeover can be made in a few minutes. Butane, or propane-butane, liquified petroleum gas mixtures may be used interchangeably.

J. F. Pritchard and Company design, engineer and construct complete *Stand-By* fuel plants to specifications, covering all types of fuel.

J. F. PRITCHARD and Company, *Natural Gas Division,* Fidelity Building, Kansas City, Missouri.

KANSAS CITY
TULSA
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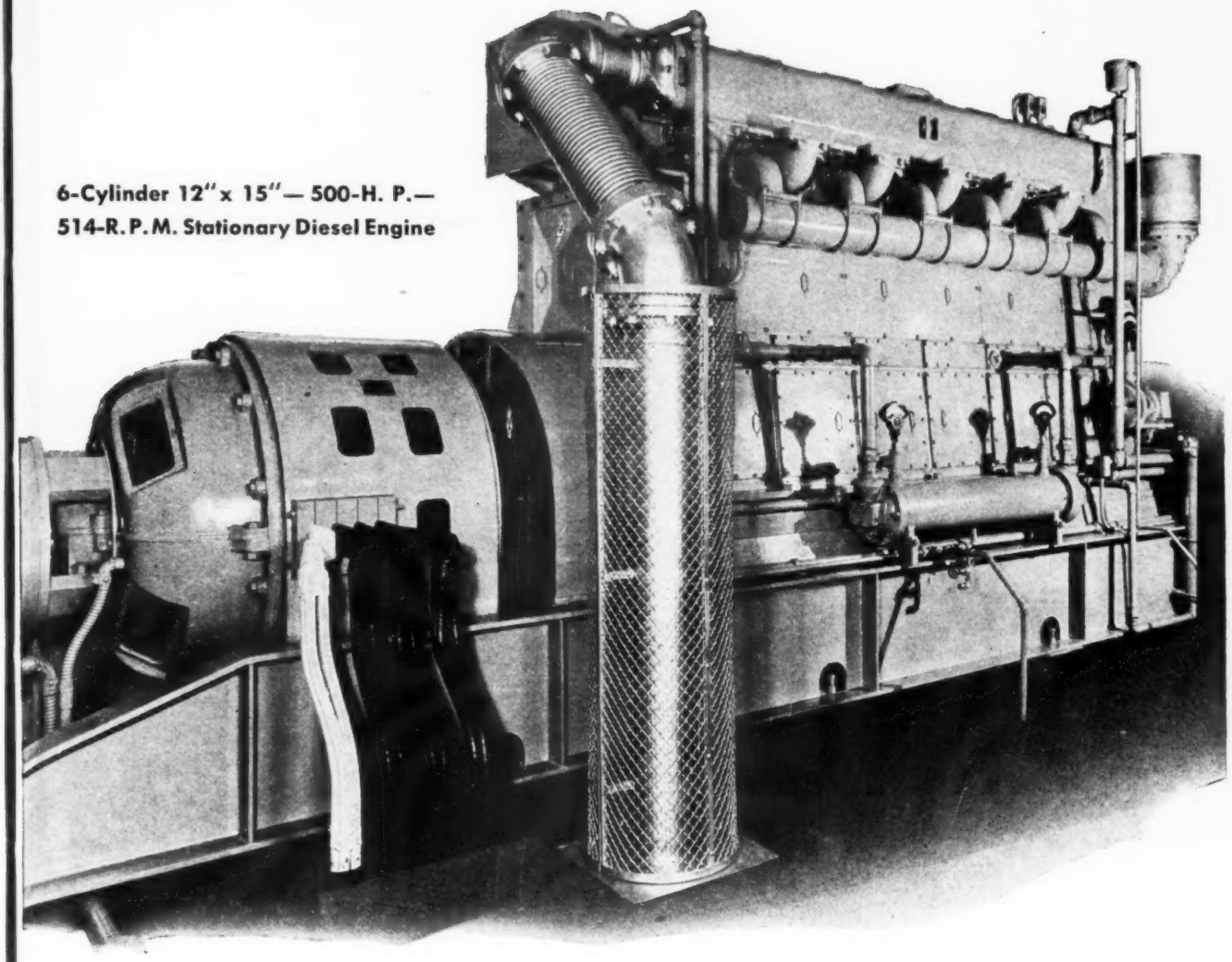
Pritchard

HOUSTON
NEW YORK
PITTSBURGH

ENGINEERS AND CONSTRUCTORS
FOR THE CHEMICAL • PETROLEUM • GAS AND POWER INDUSTRIES
Manufacturers of Mechanical and Atmospheric Cooling Towers

SUPERIOR DIESELS

dependability proven by American industry



6-Cylinder 12" x 15" — 500-H. P.—
514-R.P.M. Stationary Diesel Engine

ALL over America Superior Diesels are getting the important jobs because their reputation for unfailing economical, vibrationless power has been proven many times.

It is characteristic of Superior Engines that they do every job a little better than is required. In engineering, in manufacture and in performance, world tested Superior Diesels have always exceeded the claims advanced for them.

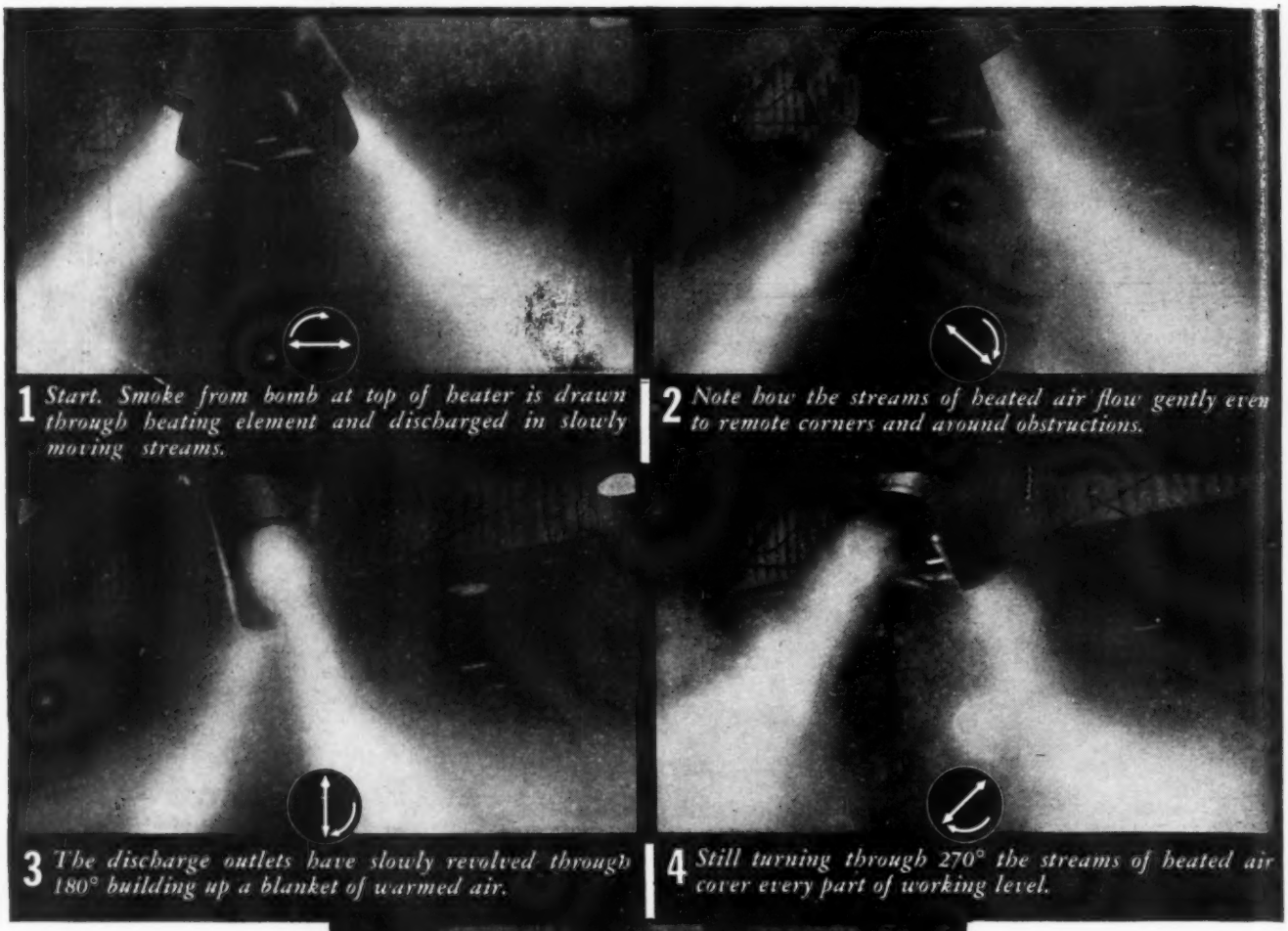
SUPERIOR ENGINES

Division of The National Supply Co.

Executive Offices: Pittsburgh, Pa.

Sales Offices: Springfield, Ohio; Boston, Mass.; New York, N.Y.; Philadelphia, Pa.; Jacksonville, Fla.; Houston, Texas; Fort Worth, Texas; Tulsa, Oklahoma; Los Angeles, Calif.; Chicago, Ill. Factory: Springfield, Ohio.

WHY *Revolving* UNIT HEATERS ARE MOST EFFICIENT



1 *Start. Smoke from bomb at top of heater is drawn through heating element and discharged in slowly moving streams.*

2 *Note how the streams of heated air flow gently even to remote corners and around obstructions.*

3 *The discharge outlets have slowly revolved through 180° building up a blanket of warmed air.*

4 *Still turning through 270° the streams of heated air cover every part of working level.*

5 *The discharge outlets have completed one revolution demonstrating conclusively the thorough coverage of the WING Revolving Unit Heater.*

The "smoke bomb" tests shown in these pictures are a convincing demonstration of the way in which WING Revolving Unit Heaters slowly spread a blanket of warmed air over the working area.

WING TIPS:

Many manufacturers who waited too long last winter to order their Revolving Unit Heaters were disappointed. Don't let this happen to you this year.

THERE is no other system of factory heating that can do what an installation of WING Revolving Unit Heaters does for factory workers. WING Revolving Unit Heaters gently circulate the warm air around bulky machinery and other obstacles and into otherwise cold corners, assuring a comfortable temperature at every part of the working level. The gentle air movement brings a sensation of fresh, live, invigorating warmth to workers.

Write for a copy of Bulletin HR-2.

158 West 14th St., New York. **L. J. Wing Mfg. Co.** Factories: Newark, N. J.

WING *Revolving* UNIT HEATERS

Enlarged Field Storage

for plants burning 500 tons per hour, or less than 50 tons a day

● Give your plant maximum protection against shut-downs resulting from mine strikes and fires, transportation delays, etc., with a Bartlett-Snow Coal Storage and Reclaiming System.

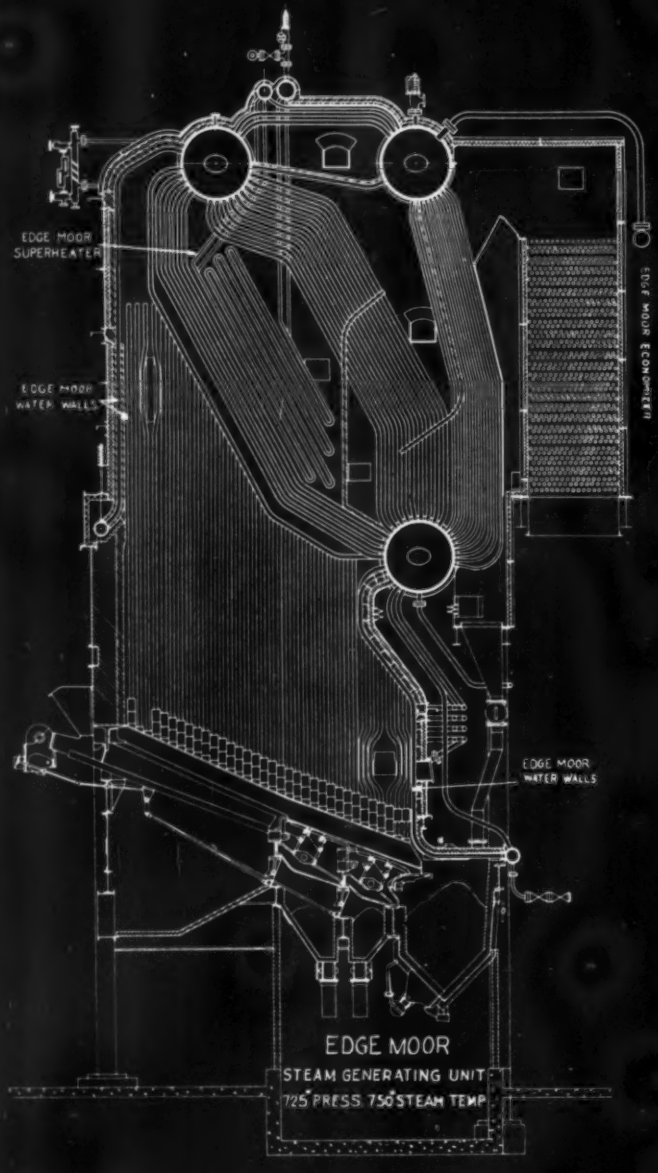
These systems are readily adaptable to practically any existing coal handling system. They make maximum use of your existing facilities . . . are not costly to install . . . and practically eliminate any fire risk. Bartlett-Snow Systems store and reclaim coal for only a few cents per ton. They require the services of only one man —only when coal is being handled—and involve little operating or maintenance cost.

Now—when the need is so urgent—investigate thoroughly the possibilities of increasing your field storage facilities. Recommendations, and estimates of cost of the system best suited to your particular plant and yard conditions, furnished promptly—Simply send a blue-print, photograph, or rough pencil sketch giving approximate dimensions, distances, capacities desired, etc., to—Coal Handling Department, The C. O. Bartlett & Snow Co., 6205 Harvard Avenue, Cleveland, Ohio. Why not do it now —Today—there's no time to lose!

BARTLETT-SNOW COAL HANDLING

CENTRAL STATIONS and INDUSTRIAL POWER PLANTS

TRACK HOPPERS • SKIP HOISTS • BUCKET ELEVATORS • BELT CONVEYORS
BINS AND BUNKERS • WEIGH LARRIES • FIELD STORAGE • ASH HANDLING



Here's Proven Efficiency with No Design Problems

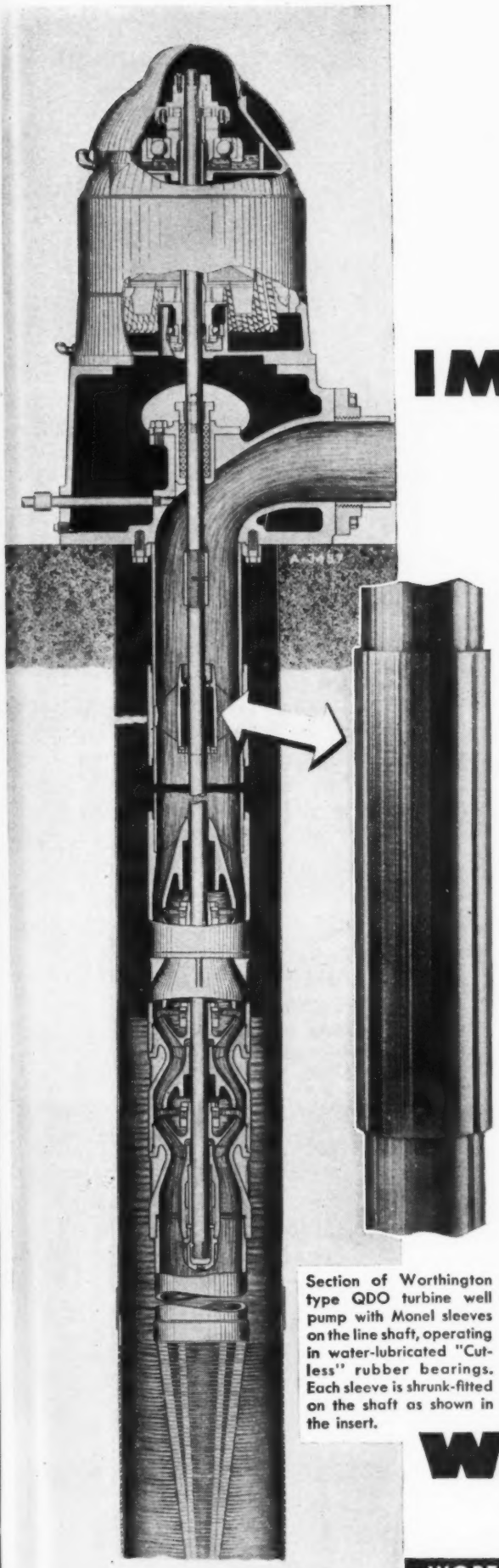
In several recent installations, Edge Moor Steam Generators, three drum type, are operating successfully at a pressure of 725 lbs. and a final steam temperature of 750°F, each producing 150,000 lbs. per hr. In this compact design boiler furnaces are completely water cooled and high efficiency is obtained by the inclusion of an Edge Moor economizer of the horizontal tube return bend type.

Since all engineering work has been completed, these units can be reproduced with a minimum of delay.

Complete installation service is available through Edge Moor, including Boilers, Superheaters, Water Walls, Economizer and Air Preheater.

Edge Moor **IRON WORKS, INC.** EDGE MOOR DELAWARE

NEW YORK—30 ROCKEFELLER PLAZA . . . CHICAGO—#1 NORTH LA SALLE STREET
IN CANADA—UNITED STEEL CORPORATION, LIMITED, TORONTO



Section of Worthington type QDO turbine well pump with Monel sleeves on the line shaft, operating in water-lubricated "Cutless" rubber bearings. Each sleeve is shrunk-fitted on the shaft as shown in the insert.

LUBRICATED BY WATER YET IMMUNE TO RUST

Worthington guards against corrosion and abrasion in its turbine well pump installations by using Monel sleeves on the line shafts at every bearing, to combine strength and toughness with resistance to corrosion and abrasion.

In Worthington water-lubricated turbine well pumps Monel shaft sleeves operate in "Cutless" rubber bearings installed at 10 foot intervals. This type of construction eliminates the necessity for a line shaft made entirely of a costly non-corrosive alloy metal.

In the Worthington turbine well pump line there is a type to meet YOUR requirements, whether your conditions call for water or oil lubrication.

These units are the product of the WORLD'S LARGEST PUMP BUILDER . . . one of America's pioneers in deep well pumping equipment.

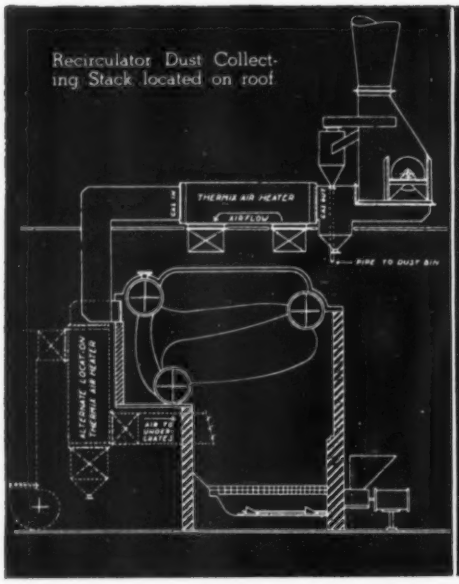
FOR FULL DETAILS SEND FOR BULLETIN H-450-B29

WORTHINGTON

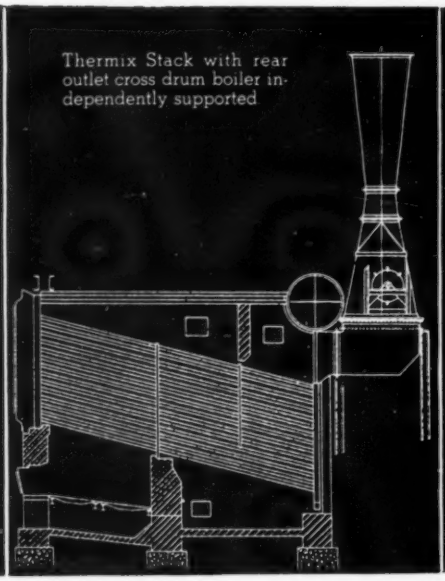
DW3-3

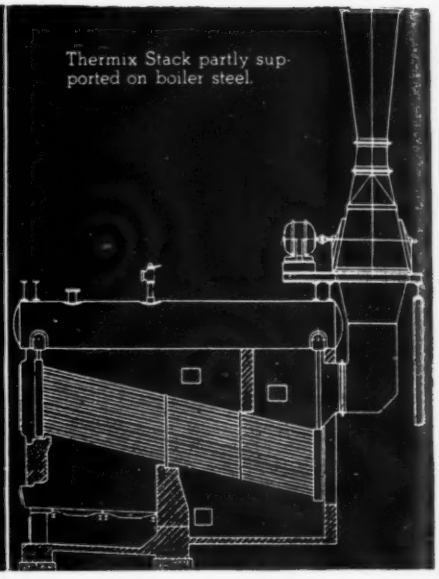
WORTHINGTON PUMP AND MACHINERY CORPORATION

General Offices: **HARRISON, NEW JERSEY** • *Offices and Representatives in Principal Cities*



Recirculator Dust Collecting Stack located on roof


Thermix Stack with rear outlet cross drum boiler independently supported


Thermix Stack partly supported on boiler steel.

What You Save With a

THERMIX FAN STACK

Thermix Fan-Stacks cost less to install because there is less material and labor in their production than for a fan, breeching and stack, or for a chimney.

They save power because of fewer bends, turns and abrupt changes of area in gas passage.

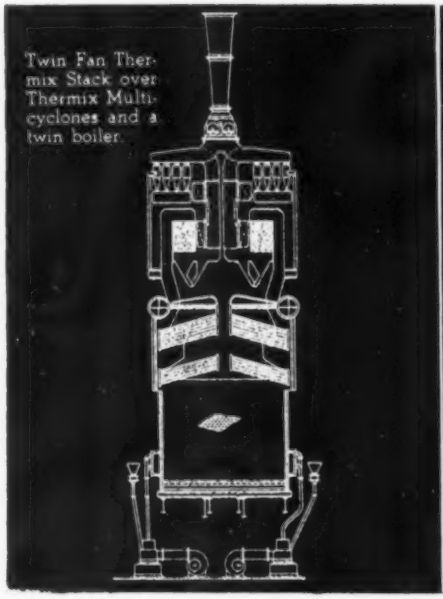
They usually save in cost of fuel because they make boilers generate more steam with CHEAPER fuel.

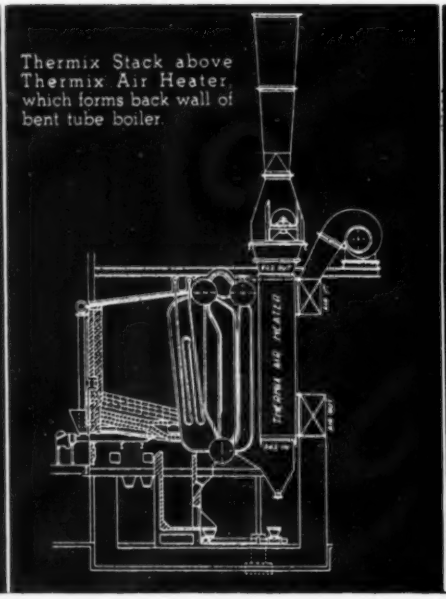
And they save steel because the breeching and fan inlet boxes are integral with the stack . . . the stack is of smaller average diameter . . . only a single support is needed for fan and stack combined . . . and all parts are combined into one apparatus.

The Thermix Stack is a combination of a Fan and Stack in *one* unit . . . operating as a unit, designed and built by a single, responsible manufacturer. You get complete coordination of the mechanical draft stack, the inlet breeching and all parts. Thousands of Thermix Stacks have been in use for years.

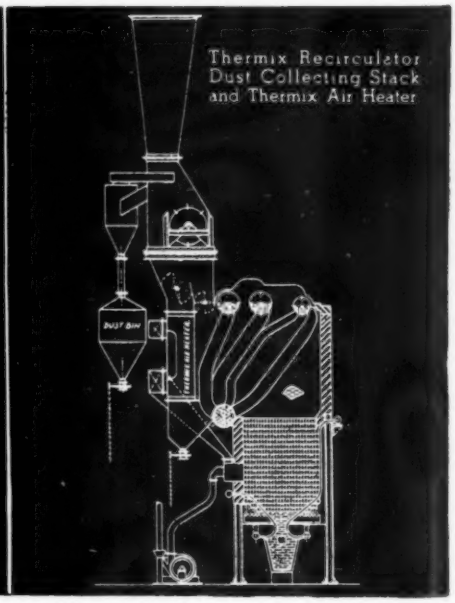
Write today for our interesting catalog No. 109.

PRAT-DANIEL CORPORATION
Port Chester, N. Y.
General Sales Agents
Thermix Engineering Co., Greenwich, Conn.
REPRESENTATIVES IN PRINCIPAL CITIES

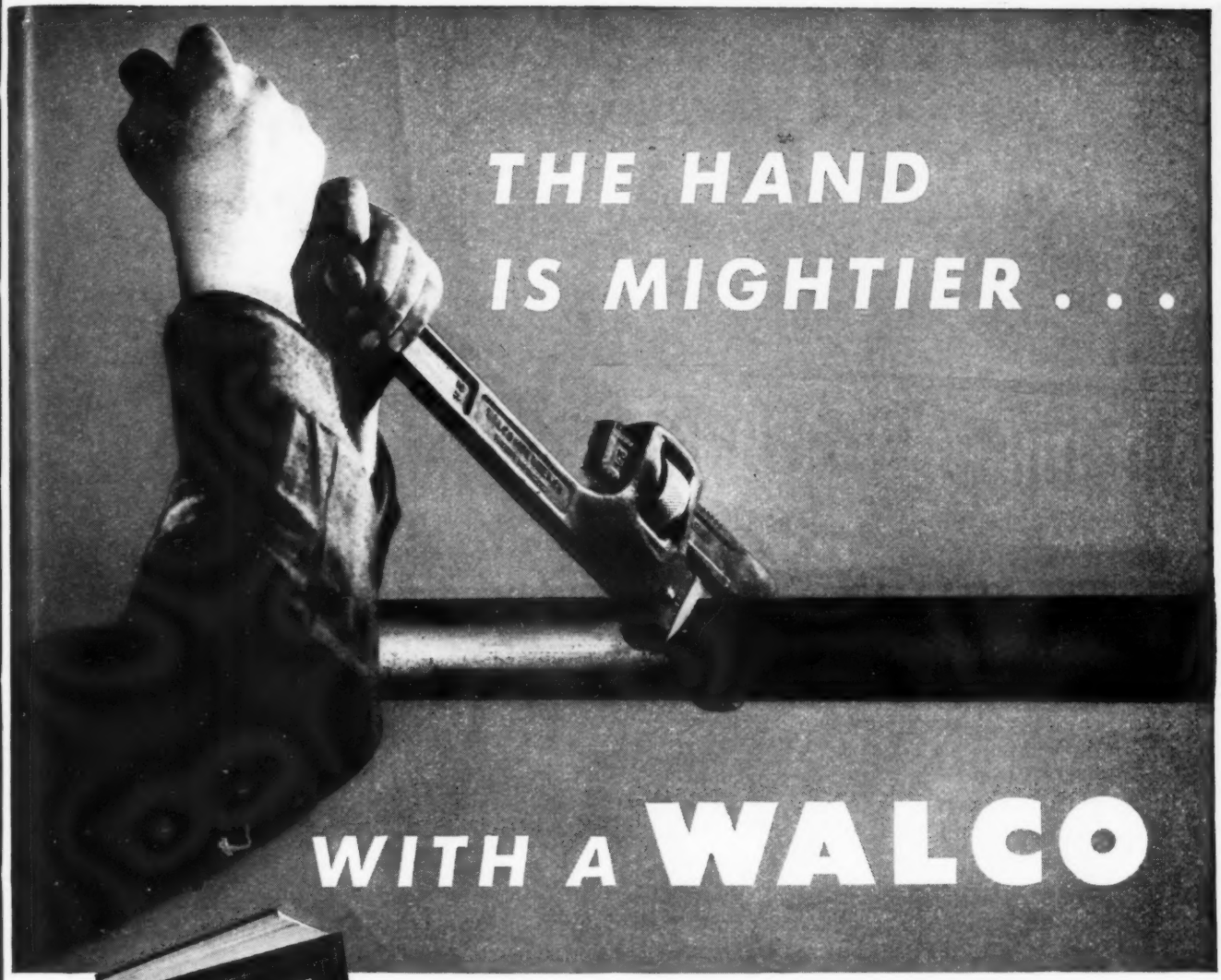

Twin Fan Thermix Stack over Thermix Multicyclones and a twin boiler.

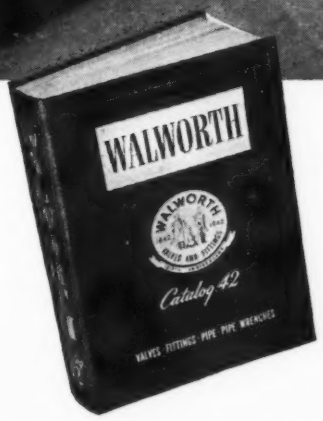


Thermix Stack above Thermix Air Heater, which forms back wall of bent tube boiler.



Thermix Recirculator Dust Collecting Stack and Thermix Air Heater





You'll find pertinent information on Walworth's complete line of valves, fittings, pipe, and pipe wrenches in the new Walworth Catalog 42. Included are 78 pages of practical engineering data that simplify valve selection and make piping layouts easier. Write, on business stationery, for your free copy. Address: Walworth Company, 60 East 42nd Street, New York, N. Y., Department 85.

Every part of a Walco wrench is designed and built for strength and safety of operation. The Walco grips and holds no matter how hard you pull. All parts of this modern wrench are **made entirely of steel.** The handle and both jaws are made of drop forged steel. The housing and handle are forged from a single piece of steel. Both jaws are carefully machined, and all parts are heat treated to provide toughness, uniformity, and strength. The cross locked lower insert jaw, which is an exclusive Walco feature, makes it easy to remove a worn lower jaw and insert a new one. The spring may be quickly and easily replaced without the use of tools. These features prolong the life of the wrench indefinitely.

Users everywhere testify to the fact that Walco is the world's strongest wrench, the safest, and by far the least expensive to use. It is made by Walworth Company, manufacturers of valves and fittings for more than a century.

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valves AND fittings

WALWORTH ★ VALVES AND FITTINGS ★ ESTABLISHED 1842

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

"REQUIRED WORKING PRESSURE"

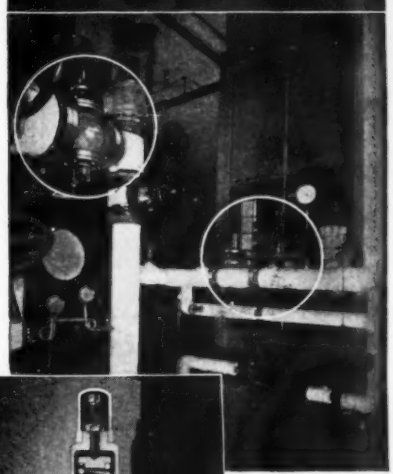
ROUND-THE-CLOCK DAY IN...DAY OUT

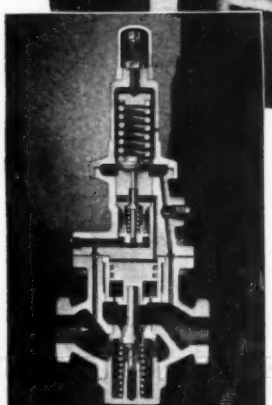
No . . . these charts are not doctored, they are shown exactly as recorded *after* the Foster Type 37-G2 Pressure Reducing Regulator was installed. In fact—*16 years after*. For 24 hours a day, every day during this time, it has delivered steam as required for intermittent processing at the working pressure recommended for the equipment . . . accurately and without maintenance other than periodic routine grinding of pilot valve "whether it needed it or not."

Sorry, we can't give you the whole story, because we don't know the *beginning*—we have no *charts* to show the irregularity of delivery before the Foster Valve was installed. But we *do* know that the foreman in charge of processing was always complaining, "How the *?!!? can you expect me to keep quality up and costs down with pressure wandering all over the lot?" — or words to that effect.

Besides, we don't yet know the *ending*. As far as we can see, there is no reason why this valve should not go on giving accurate, trouble-free regulation for many more years.

Our engineering recommendation was followed as to size and type for this service, and the valve was properly installed. And, incidentally, selection of proper size and type, and planned installation are of paramount importance in assuring satisfactory valve performance. Foster Valves consistently deliver and hold the pressure you require . . . and our engineers will be glad to see that you get the *right* valve for your specific needs, and to make recommendations for its installation. Consult us without obligation.





Typical installation of a Foster Type 37-G2 Pressure Regulator. Catalog 70 shows many other installation suggestions and illustrations, including proper control connections and by-pass arrangements.

Complete, illustrated handbook on Foster Type 37-G2 and other Reducing Valves, Temperature Regulators, Pump Governors and Sirens—with eight pages of useful engineering data—will be sent if the request is made on company letterhead. Simply ask for Catalog 70.

Foster Type 37-G2 auxiliary or pilot operated valves for steam are built with a variety of spring ranges and of alloys suitable for the pressure and temperature—initial pressures up to 1500 pounds—delivery pressures up to 1200 pounds—total temperatures up to 900° F.

FOSTER ENGINEERING Company

PRESSURE REGULATORS...RELIEF AND BACK PRESSURE VALVES...AUTOMATIC STOP AND CHECK VALVES...ALTITUDE VALVES...DAMPER REGULATORS...FAN ENGINE REGULATORS...PUMP GOVERNORS...TEMPERATURE REGULATORS...LIQUID LEVEL CONTROLLERS...FLOAT AND LEVER BALANCED VALVES...NON-RETURN AND TRIPLE DUTY VALVES...VACUUM REGULATORS OR BREAKERS...SIGHT FLOW BOXES...STRAINERS...SAFETY VALVES...SIRENS

MONROE STREET • NEWARK, N. J.

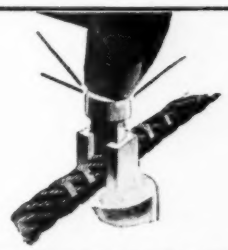
"Old friend . . . fine wire rope"

Several thousand miles to the west of where you're reading this, an American face lights up as a welcome friend from home arrives.

Back here in the States, like thousands of others now in uniform, he learned the friendliness of dependable Wickwire Rope.

He knows *you* need Wickwire Rope, too, to keep things running on the home front. So he appreciates *your* contribution in making the rope you already have last longer, so more can be spared for the important work over *there*. But when you *do* order, won't you take it in coils when the lengths permit—so the handier reels can go to the front? Wickwire Spencer Steel Company, 500 Fifth Ave., New York.

For outstanding production accomplishments, Wickwire Rope was the first in all New England to win the coveted Maritime M and Victory Fleet Flag.



WHEN CUTTING WIRE ROPE, seizing is important, whether it is preformed or standard lay. The free book "Know Your Ropes" will help your new men (old, too!) learn the right and wrong ways to care for and handle wire rope to make it last longer. Send for your free copy.

SEND YOUR WIRE ROPE QUESTIONS TO WICKWIRE SPENCER

WICKWIRE ROPE

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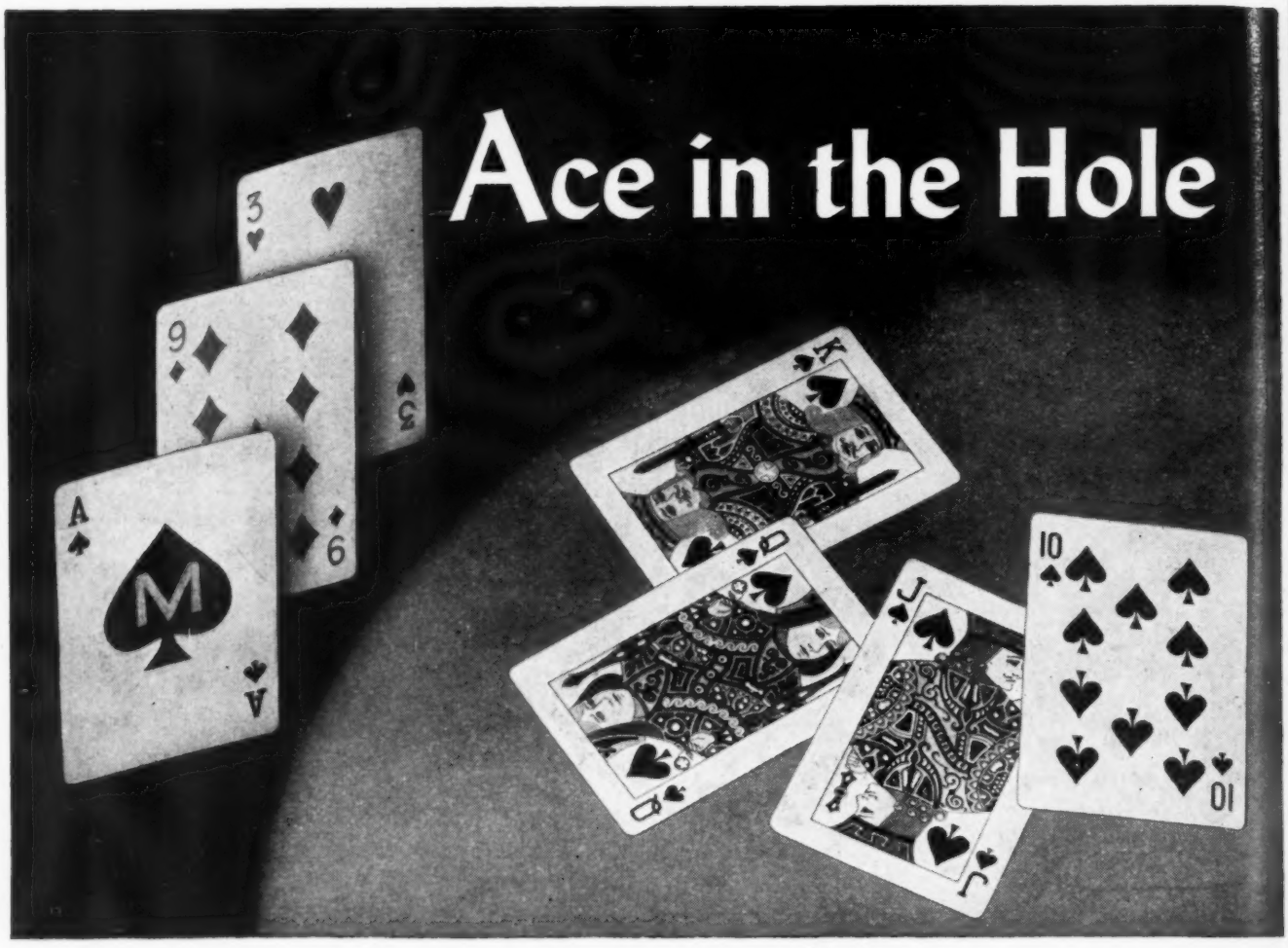

The player with an ace in the hole—an ace that will complete a Royal Flush—takes the money.

The plant that can market a better product, and sell it for less, will take more than its share of the post-war business in its field.

Morse Chain Drives, we know from experience, can help many a manufacturer with a power transmission problem to better both the quality and quantity of his post-war production—and enable him to sell at lower cost. For this reason, Morse Drives at work in your plant or in the machines you build can be, potentially, an ace in the hole that will help you beat tough competition.

If you are looking ahead, planning a post-war program—make it a point to talk to your nearest Morse man. He can give you facts and figures, and show you why Morse Drives merit your serious consideration, regardless of the type drives you now employ.

Right now, Morse, like most manufacturers, is all out on war work . . . and eager to help others producing the weapons of war. Tomorrow, when peace comes, Morse plans to serve you better . . . to apply well-learned lessons that will help you, and Morse, to grow.

Pioneering—Morse Rocker Joint Super Drives are opening up new fields beyond present power transmission ranges. 3/16" pitch Morse Drives are being used in transmitting no-load timing motions, other Morse Drives are employed in precision machining operations—because they can't slip. Daily, Morse engineers are finding better answers to power transmission problems.

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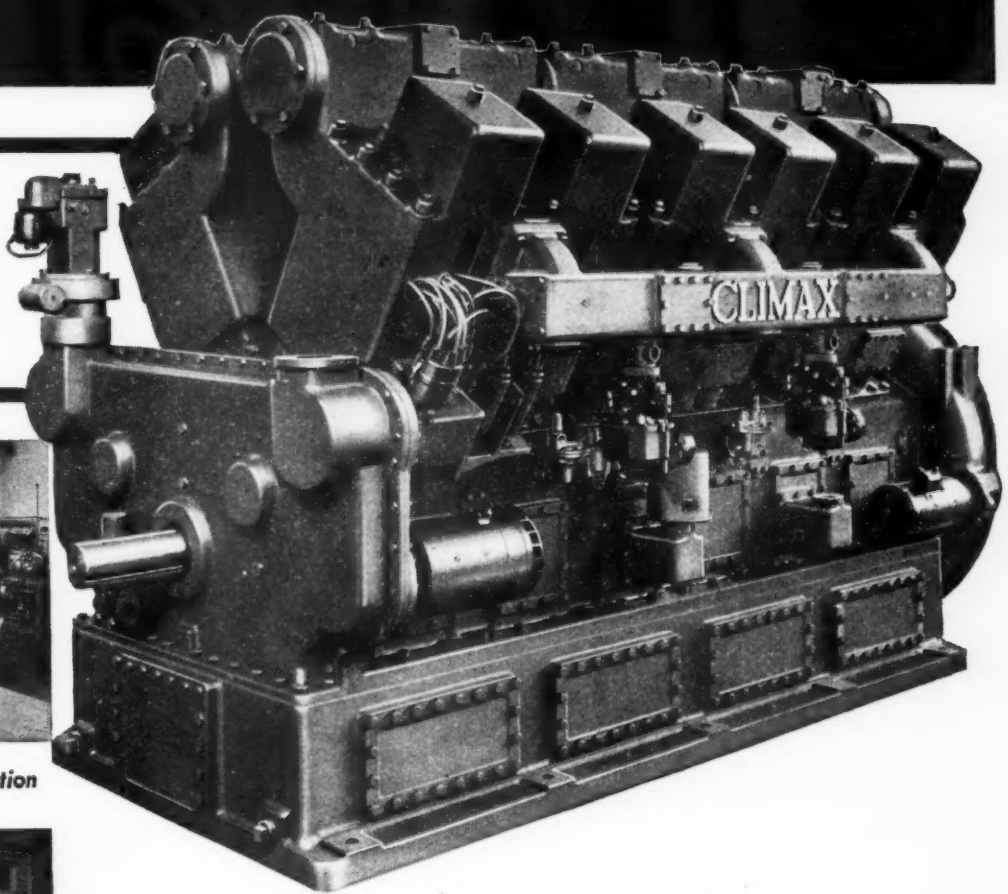
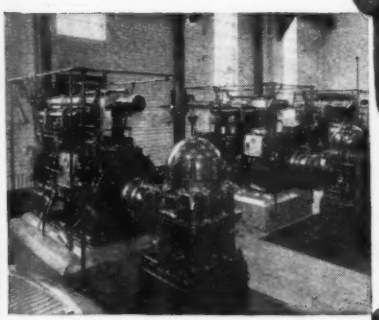
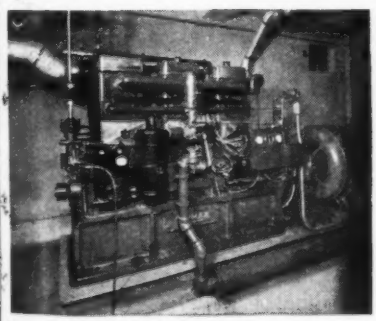
A Heavy Duty War Worker With a Peacetime Future





For Fast-Moving War Construction



For Electric Power and Light

The New Climax 12-Cylinder V-Type Engine

When you need dependable self-generated power, mechanical or electrical, consider these new Climax V-design 12-cylinder engines for your requirements. The rugged construction of the V-12 will render you many years of dependable brute power with a minimum service upkeep cost. As a stand-by generating unit to take care of emergency power failures the new V-12 can be easily started to take over with a minimum of delay thus reducing shut-down time and operating costs.

For stationary power either mechanical or electrical in factories, office buildings or municipal plants the new V-12 is extremely dependable and economical to operate and is an investment which will quickly pay for itself.

HERE IS SOME DATA

GENERATING CAPACITY

Model V-335 develops 375 hp. at 1200 r.p.m.

Model V-390 develops 435 hp. at 1200 r.p.m.

FUELS USED

Burns natural gas, butane, gasoline and other fuels. Change over is quick and easy with outside located accessories. Optimum performance is possible through dual carburetors.

DUAL IGNITION

Available with dual battery, dual magneto or battery and magneto. Has two spark plugs per cylinder.

FEATURES INCLUDE

Aluminum pistons, rifle drilled connectings rods, 7 bearing crankshaft, water cooled manifold, overhead valves. Complete accessory equipment available.

WRITE for more complete information today.

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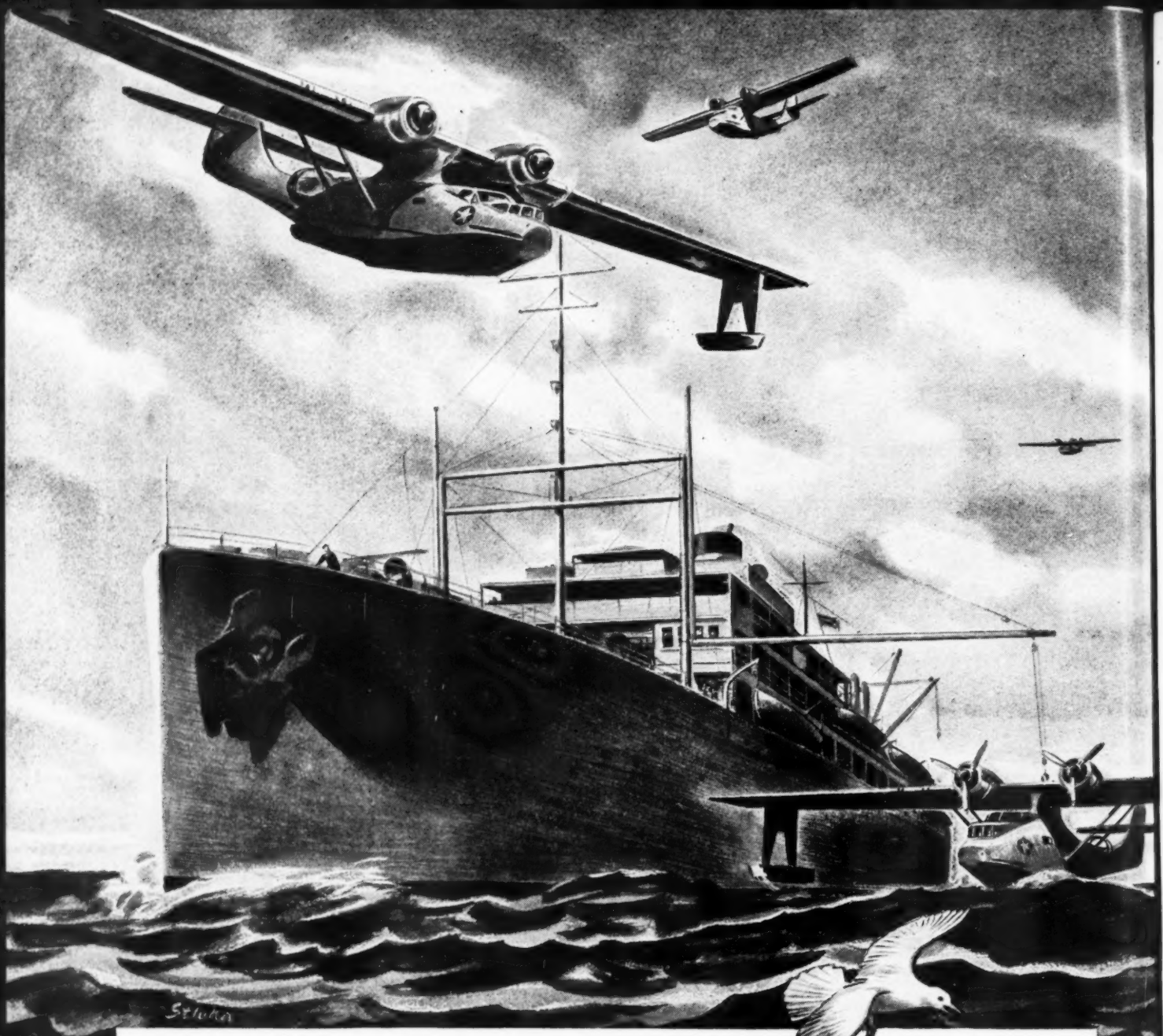

Eyes and Ears of the Fleet

You hear more of other craft than of Seaplane Tenders — but from Pearl Harbor on they've been in there . . . patrolling . . . listening . . . *fighting*. A Jap fleet moves toward the Solomons. Long before it is within range of land-based aircraft, Seaplanes from a Seaplane Tender have spotted it. From then on the officers of America's fighting forces know every move of the enemy, and what to do about it, for example, the Bismarck Sea!

To provide both propulsion and auxiliary Diesel engines for these and other important warcraft of the U. S. Navy is the assigned task of Fairbanks-Morse. It is a task of which we are proud. We feel that nothing less than our level best is good enough.

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GET THAT UNIT BACK

WHEN condenser trouble makes shut-down of a vitally needed unit imminent and unavoidable—it's *a job for specialists*. Call Conseco, and schedule a rush job — between peaks if possible.

In a short time after actual shut-down, with our special hydro-dynamic shock test, we can tell you how many bad tubes you have. If the number is small, and plugging will get you by for a reasonable length of time, we'll give you the good news and have you back in service *pronto*.

If the percentage of weak tubes is seriously high, we'll tell you that, too, and give you a report on what has to be done, and how *fast* we can do it — and we mean *FAST*.

Where retubing is found to be necessary, we can usually complete the job in one off-peak down — because we are specialists and because we have the know-how, the facilities and often the materials.

For fifteen years, now, we have been servicing condensers and heat exchangers for utilities and industrial power plants throughout the nation. During this time we have developed our own time-saving tools and methods to give you a better, faster job. Today we are operating on a clock-around schedule — *Emergency Service* is our normal business. Don't hesitate to call us any hour of the day or night.

Condenser Service
AND ENGINEERING CO., INC.

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NEW YORK TELEPHONE—RECTOR 2-9360 **AFTER 6 P. M. AND SUNDAYS—HOBOKEN 3-4428**

8-CS-1

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Shown above is one typical arrangement of the units in this B-B Coal Handling System.

Write us today for complete details.

Designed to fill today's needs for handling coal in either new installations or oil-coal conversion, this system offers numerous advantages. Send for full information.

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MANUFACTURERS AND ERECTORS OF COMPLETE COAL AND ASH HANDLING SYSTEMS

KEEP FURNACES OPERATING AND KEEP PRODUCTION UP

Has a P.C.E. of 3000° F plus

Lay up your furnace linings with Adamant Fire Brick Cement that makes the joints as strong as the brick they bond. Get added life before relining is needed. Impartial laboratory tests prove this great strength. Let us tell you about them and Adamant.

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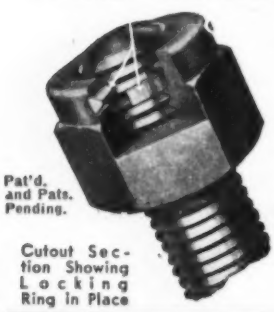
JUST TIGHTEN IT AND IT'S THERE TO STAY

UNSHAKO
Reg. U. S. Pat. Off.
Self-Locking Nut



Pat'd. and Pats. Pending.

Cutout Section Showing Locking Ring In Place

Designed on brake band principle, a built-in self-energizing locking ring keeps the nut from unwinding under vibration. Entirely self-contained, the "Unshako" is applied and removed like ordinary nut. Can be used again and again. Further information gladly sent upon request.

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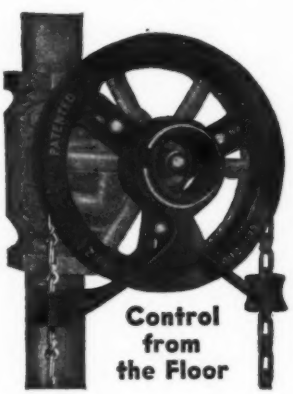
Make Your Overhead Valves SAFE And Easy to Reach---



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New Bedford, Mass.

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mechanical engineering and applications

Here are 2276 pages of data constantly needed by engineers, machinists, designers, draftsmen, plant and shop employees in every branch of mechanical engineering. Arranged in handy reference form are answers to thousands of questions of every type—covering theory, standards and practice—compiled by experts in many lines.

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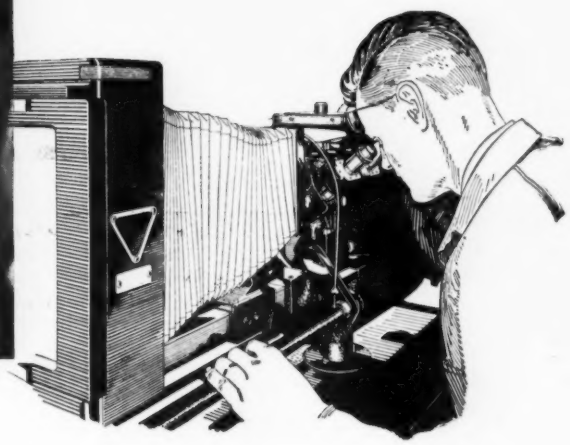
Company .....FP. 8-43

TODAY is Yesterday's Pupil



Wartime Production and Post War Planning go hand in hand . . .

TODAY the feverish tempo to produce more and ahead of schedule pervades the atmosphere in all production departments. New techniques, new methods, new and improved processes of manufacture are constantly being developed, and the high standards of quality are maintained or enhanced through rigid inspection, test, and careful analysis.

Naturally, the information thus gained is already being carefully studied for adaption to postwar production of fabricated piping for peacetime applications.

With welding playing such a major part in high pressure, high temperature, and stainless piping fabrication, accurate control of welding procedure through constant test and metallurgical analysis is of paramount importance.

Our facilities and personnel for performing this important work is of the finest, and coupled with more than forty years successful experience in designing, engineering, fabricating and erecting single units or complete piping systems, assures you of obtaining the highest quality in equipment and service.

Start your postwar program today. Our engineers will gladly help you plan improvements, additions, or complete new plants. Our products and services include: COMPLETE PIPING SYSTEMS for Central Station, Chemical and Process Plants; Industrial Piping, designed, fabricated and installed; CREASED BENDS, SUPERFLEXIBLE CORRUGATED TANGENTS; WELDED TUBING and FABRICATED STAINLESS PIPING; STAINLESS WELDING FITTINGS, TANKS and VESSELS. Contact our nearest representative or write us direct. There is no obligation.

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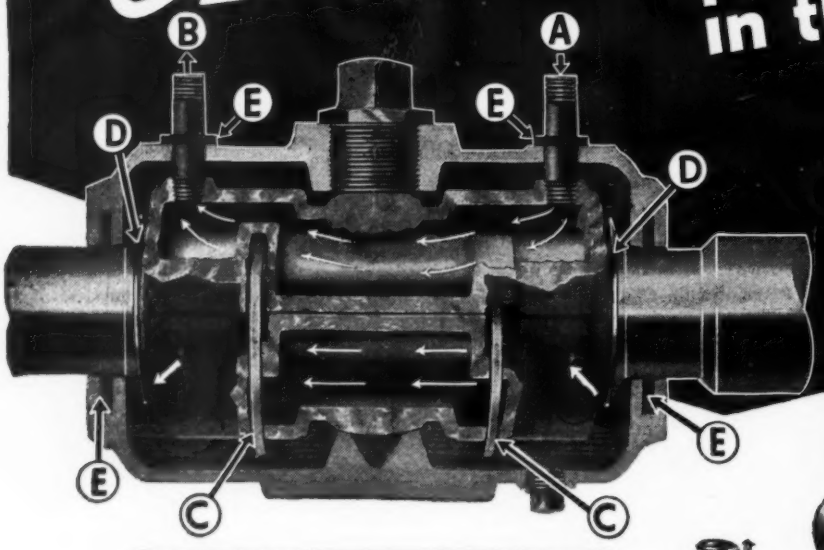
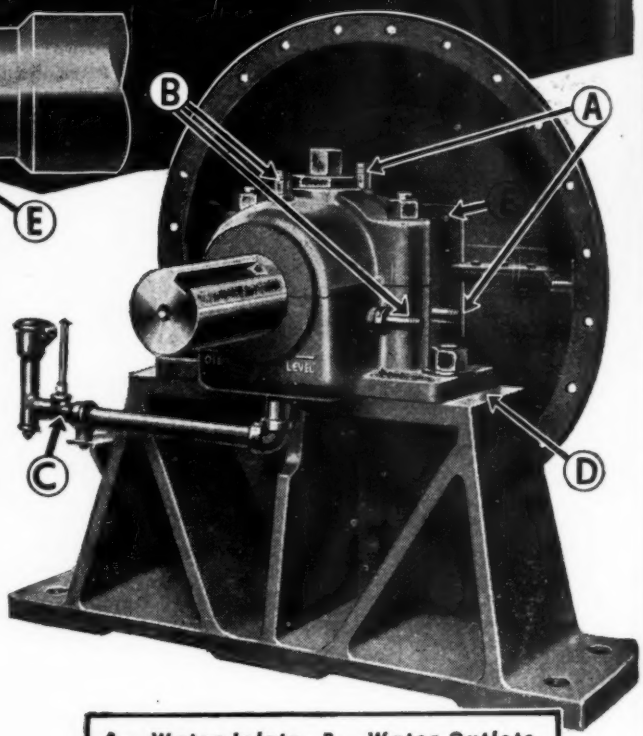
Another Reason Why CLARAGE is Ace-High in this Toughest of ALL Fan Services



A—Water Inlets. B—Water Outlets. C—Oil Rings. D—Thrust Collars (forged, turned and ground); integral part of shaft. E—Seals prevent dust leakage into bearing.



A—Water Inlets. B—Water Outlets. C—Oil Filler Cup and Pipe. D—Bottom of Bearing and top of Support machined for accurate alignment. E—Shaft Seal prevents escape of gases from fan.

BETTER BEARINGS GUARD Against Operating Failures on Vital War-Time Jobs!

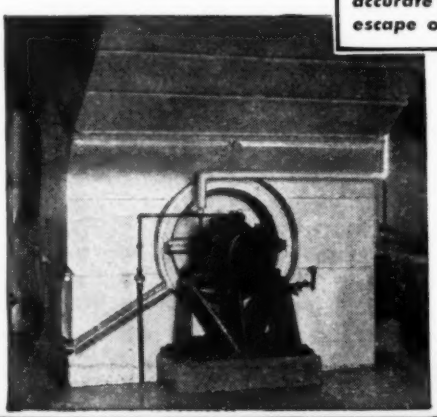
Wheel tip speeds may run as high as 4 miles per minute—temperatures may exceed 700° F.—that's modern induced draft—*toughest of all fan services!*

To meet such requirements successfully, Clarage Type RT Fans have water-cooled bearings of liberal size, as shown above. Note high grade construction and precision features.

Note, too, that cooling water is circulated through each half of the bearing sleeve independently of the other—no joints or gaskets—no possibility of water leaking into bearing lubrication.

These BETTER bearings are an important factor in assuring each Clarage RT Induced Draft Fan a trouble-free service life far longer than normal expectancy.

And this ability to out-perform and out-last is equally characteristic of other Clarage Fans and Blowers. If you have ANY war-time air-handling problem, it will pay you to get in touch with us.



RT Induced Draft Fan servicing public utility—one of over 2,000 Clarage power plant installations. Water-cooled bearings in foreground — big husky ones OK for any operating condition.

COMPLETE AIR CONDITIONING
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FANS and BLOWERS for INDUSTRIAL NEEDS

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NOT A MOMENT OUT FOR REPAIRS

on MONEL seamless tubing exposed to high pressures and temperatures for two to three years

HEATER OPEN, Showing seamless Monel tubing ¾" OD by .065" wall, calculated to carry 11,500 lbs. p.s.i. unit stress in the tube wall metal. Corrugated joint gaskets are made from Monel sheet.

ASSEMBLED HEATER. Shell carries steam at 770°F. and 650 lbs. pressure. Feed water, while passing through tubes at 2000 lbs. pressure p.s.i. is heated to 475°F.

2000-lb. water pressure p.s.i. *inside* . . . steam at 770°F. *outside*.

That's the extremely tough combination met with brilliant success by Monel seamless tubing in boiler feed water heaters, built by the Griscom-Russell Co., New York, N. Y., for the Oswego Station of the Central New York Power Corporation.

These heaters have U-tubes to eliminate necessity for floating head construction as the U-bends take care of differential expansion.

Four heaters with Monel tubing were placed in service at this station during 1940-41.

They have not been idle a moment . . . nor cost a penny . . . for repairs!

Monel performs faultlessly because of its *unique combination of properties*. Monel retains strength and toughness at high temperatures. It resists the formation of corrosion film which would decrease the efficiency of heat transfer properties.

Monel tubing in these heaters, bought before the war, helps supply essential war power today . . . when current Monel production is devoted to direct military needs.

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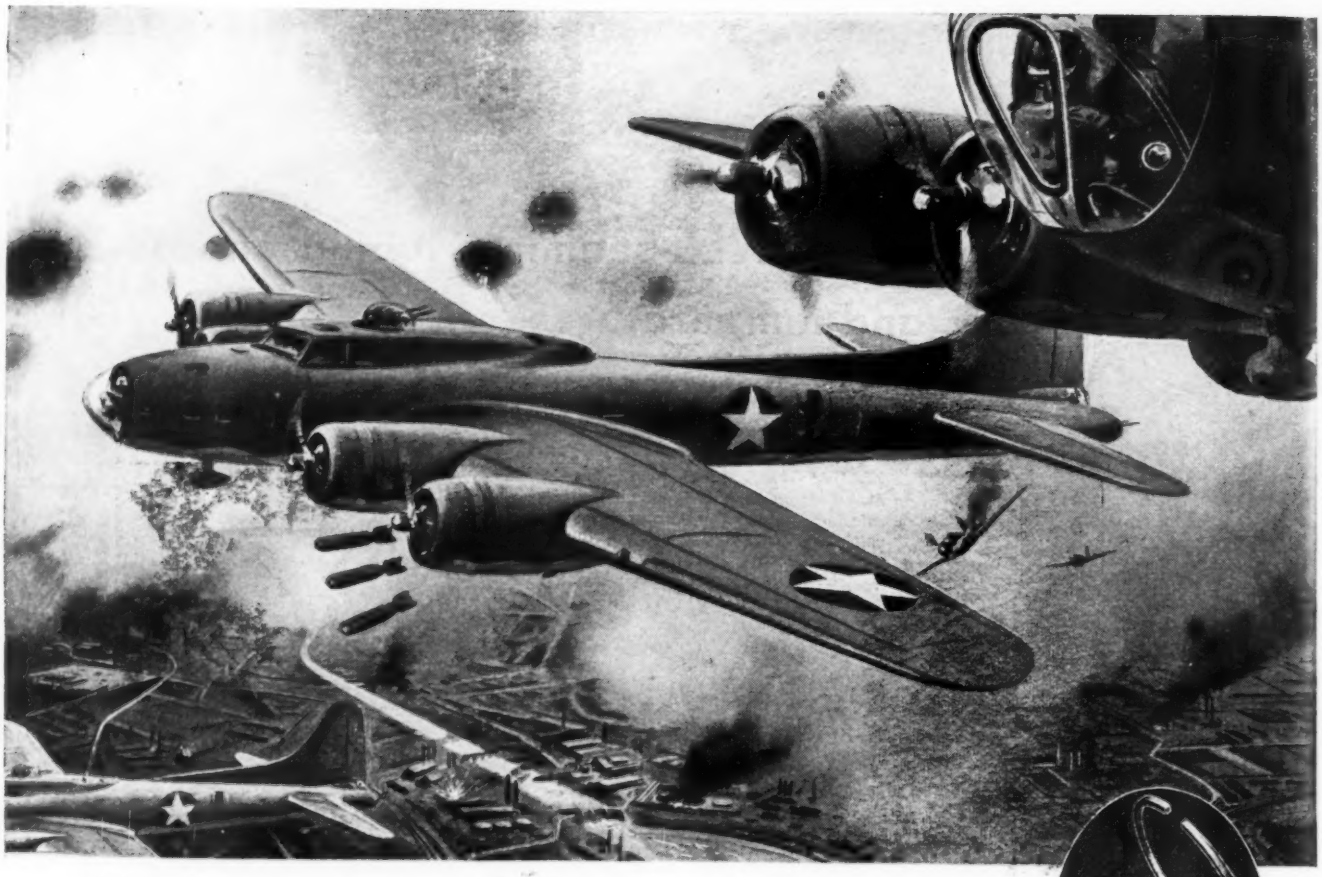
Sheet...Strip...Rod...Tubing...Wire...Castings



WHEN INVASION BOMBERS DUMP CARGOES OF DEATH

PEDRICK PRECISION brings 'em back

● Four-motored birds of prey swarm high overhead . . . brush earth's blue dome with their tail-feathers . . . open their claws to hurl death and destruction on invasion-targets miles below. Timed to split seconds, they dare not miss a single wing-beat.

Flying with these invasion bombers are Pedrick *precisioneered* piston rings. They fly in another sense, too, back and forth on cylinder-walls, faster than eye can follow. Thanks to Pedrick's heat-shaping process, they retain their tension, dimension, and flatness, even when only 1/16 of an inch wide!

In American and Allied bombers, fighters, jeeps, half-tracks, trucks, or PT boats . . . wherever compression is of first importance and precision is a *must* . . . Pedrick rings stand up and deliver in battle. They also save oil and fuel on the home-front, as they deliver full power to essential trucks, buses, tractors, and passenger-cars. Put your faith in Pedrick!

HOARDING IS PATRIOTIC . . . PROVIDED YOU'RE HOARDING WAR BONDS

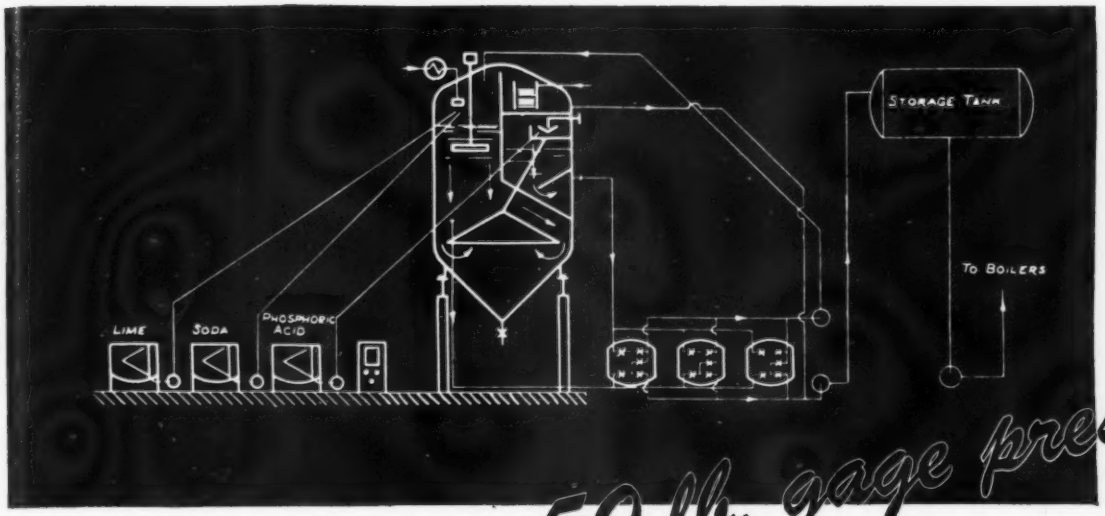
WILKENING MANUFACTURING CO., Philadelphia and Scranton, Pa. *In Canada:* Wilkening Manufacturing Co. (Canada), Ltd., Toronto.

TO POWER ENGINEERS AND MAINTENANCE MEN

Our latest catalog shows how Pedrick makes *precisioneered* piston rings for superior performance and gives recommended installations for various types of pistons and service-conditions. It will be extremely helpful to you now when you must maintain present equipment up to peak-efficiency. Write for a copy.

Pedrick

precisioneered PISTON RINGS



Above is shown the arrangement of Cochrane Hot Process Softener for high pressure, high temperature system.

50 lb. gage pressure 298° F. temperature

COCHRANE HOT PROCESS SOFTENER OPERATING AT HIGH PRESSURE AND HIGH TEMPERATURE IMPROVES PERFORMANCE AND SAVES ON CHEMICALS

THE effectiveness of the hot process softener at high pressures and high temperatures is demonstrated in a recent Cochrane installation.

Whereas most hot process softeners operate at low pressures and seldom over 15 to 20 lb. gage, this softener is operating at 50 lb. gage, with an operating temperature of 298° F.

The chemicals used are lime and soda ash and phosphoric acid. The installation has a softening capacity of 28,000 g p h of raw water and a capacity to heat and deaerate condensate at a rate of 16,000 g p h.

Softening is carried out in 2 stages. In the first stage the water is treated with lime and soda ash. Then it is decanted to a second compartment where it is deaerated and then treated with phosphoric acid to reduce the hardness and alkalinity remaining after the lime-soda ash process.

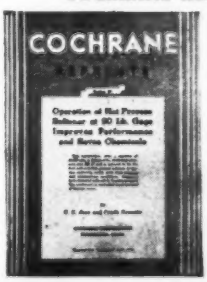
The final effluent is filtered, combined with the condensate and used as boiler feed without further treatment.

This has resulted in a high degree of hardness reduction and in economy of chemicals. Further details of this installation are incorporated in Cochrane Reprint No. 25. Write for a copy.

COCHRANE CORPORATION
3106 N. 17th St., Philadelphia 32, Pa.

AVAILABLE FOR REFERENCE

COCHRANE REPRINT NO. 25



"OPERATION OF HOT PROCESS SOFTENER AT 50 LB. GAGE"

By Joos and Kemmer

A reprint of this story describing in detail the above installation. If interested, this reprint should be of considerable help in solving your own water conditioning problems. Write for a copy. Use the coupon. →

COCHRANE PUBLICATION NO. 4021

COCHRANE CARBITE (CARBONACEOUS ZEOLITE) SOFTENERS

A 16 page publication describing in considerable detail the Cochrane Carbonaceous Zeolite Softening Equipment, with typical analyses, diagrams and photos of installations. A copy will be mailed on request. →

Cochrane Corporation
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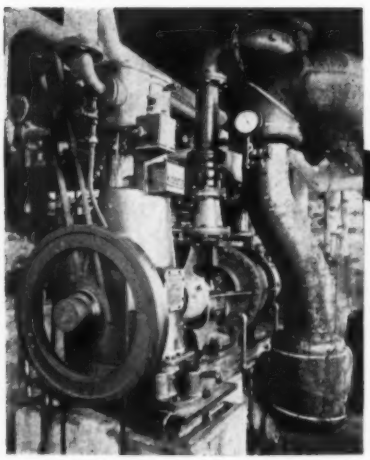
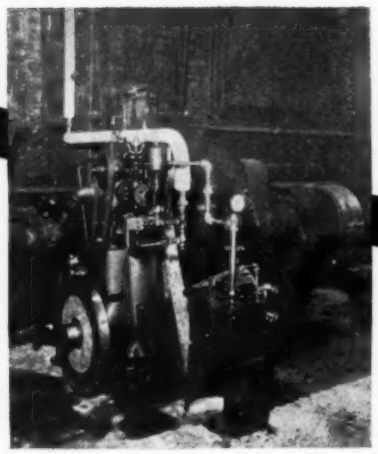
HOT PROCESS SOFTENERS • DEAERATORS • BLOW-OFF SYSTEMS • FLOW METERS • SPECIALTIES

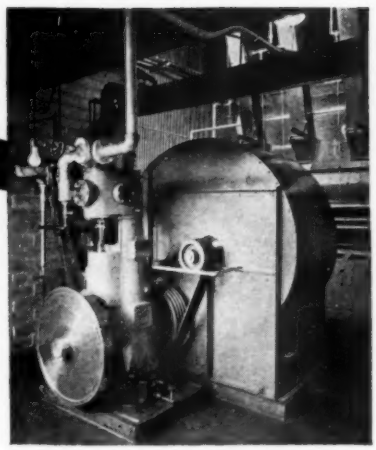
For Many Drives

Steam Engine Powe

The Troy-Engberg Steam Engine







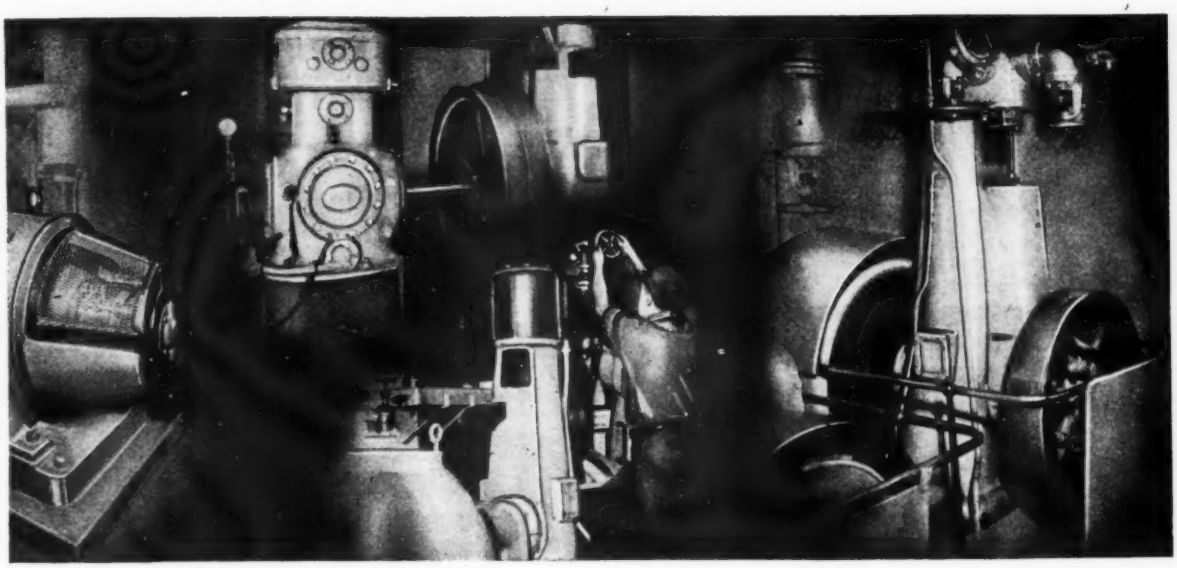
No one questions the dependability of the Troy-Engberg Steam Engine—industry's outstanding power drive of this class. Our records show hundreds of these units operating fifteen to twenty years, even longer, without need for major repairs.

When plant heat balances are right, the economy of this engine is exceptionally high. It takes only a year or two to pay off the entire cost; there is a return of from 17 to 430% on the investment.

TROY ENGINE & MACH

is the Best Power

Best *because* of its dependability
because of its economy
because of its flexibility



As for its flexibility . . . consider the step taken not long ago by a very large public utility which installed 24 Troy-Engberg Steam Engines as drives for its 48 stokers. In this installation, the speed of each engine is automatically controlled.

Dependability, economy, flexibility are combined with plus values such as high-starting torque, heavy overload capacity, explosion-proof construction, oil-free exhaust. These are the advantages of the Troy-Engberg Steam Engines.

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"TOLEDO" offers sturdy open-side pipe vises in three models No. 00 capacity ⅛ to 1½ inch pipe. No. 0 capacity ⅛ to 2½ inch pipe. No. 3 capacity ⅛ to 4½ inch pipe. Excellent for fitting make-up work.

Ratchet pipe reamers that quickly remove burrs from pipe ends. Junior Ratchet capacity ⅛ to 2 inch pipe. Ratchet Reamer capacity ⅜ to 3 inch pipe. Natural hand grip assures easy operation.

Sold by leading suppliers everywhere.

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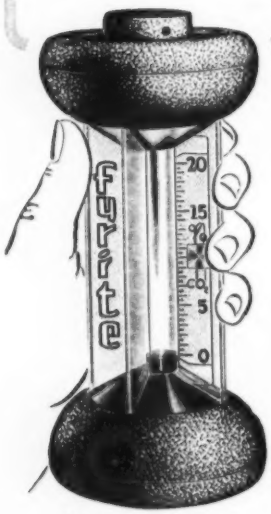
"TOLEDO"
TRADE-MARK REGISTERED U.S. PAT. OFFICE

BUY WAR BONDS AND WAR STAMPS

STOP Wasting Fuel up the Stack!

Simplified **FYRITE CO_2 Analyzer**

Indicates Stack Loss **INSTANTLY!**



$18.50 COMPLETE WITH INDUSTRIAL TYPE FLUE FILTER

BACHARACH
Industrial Instrument Co.
7000 BENNETT ST.
PITTSBURGH, PA.

Makes ACCURATE Flue Gas Analysis EASY

The first step towards fuel economy is to control chimney losses. The FYRITE "Orsat" CO_2 Analyzer makes accurate flue gas tests easy —instantly exposing fuel wasted up the stack. The FYRITE is conveniently held in the hand while analysis is taken. It is accurate within ½ of 1% CO_2; spill-proof; cold-proof; rugged, durable, compact. More than 7000 in use.

OXYGEN ANALYZER designed on same principle available soon. Write for particulars.

RETURN THIS COUPON FOR BUL. 340
on Fyrite "Orsat" and learn how to get immediate delivery under priority regulations.

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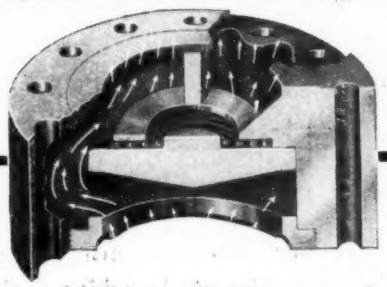
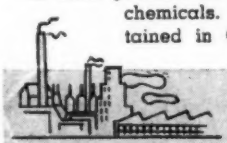
Flanged Silent Check Valves



ASSURE UNINTERRUPTED FLOW

The WILLIAMS-HAGER Silent Check Valve is tight under every condition of service and pressure. Yet it assures unrestricted and uninterrupted flow of liquids—there are no webs to hamper the flow. It will operate in any position and is of rugged, simple, compact design. WILLIAMS-HAGER Silent Check Valves can be built of semi-steel, cast steel, government bronze, stainless steel or monel metal. From 1" to 20" inclusive, pressure-resistant to 6000 pounds, and for all liquids—including oils and chemicals. Write for complete information contained in Catalog No. 142.



The WILLIAMS GAUGE COMPANY

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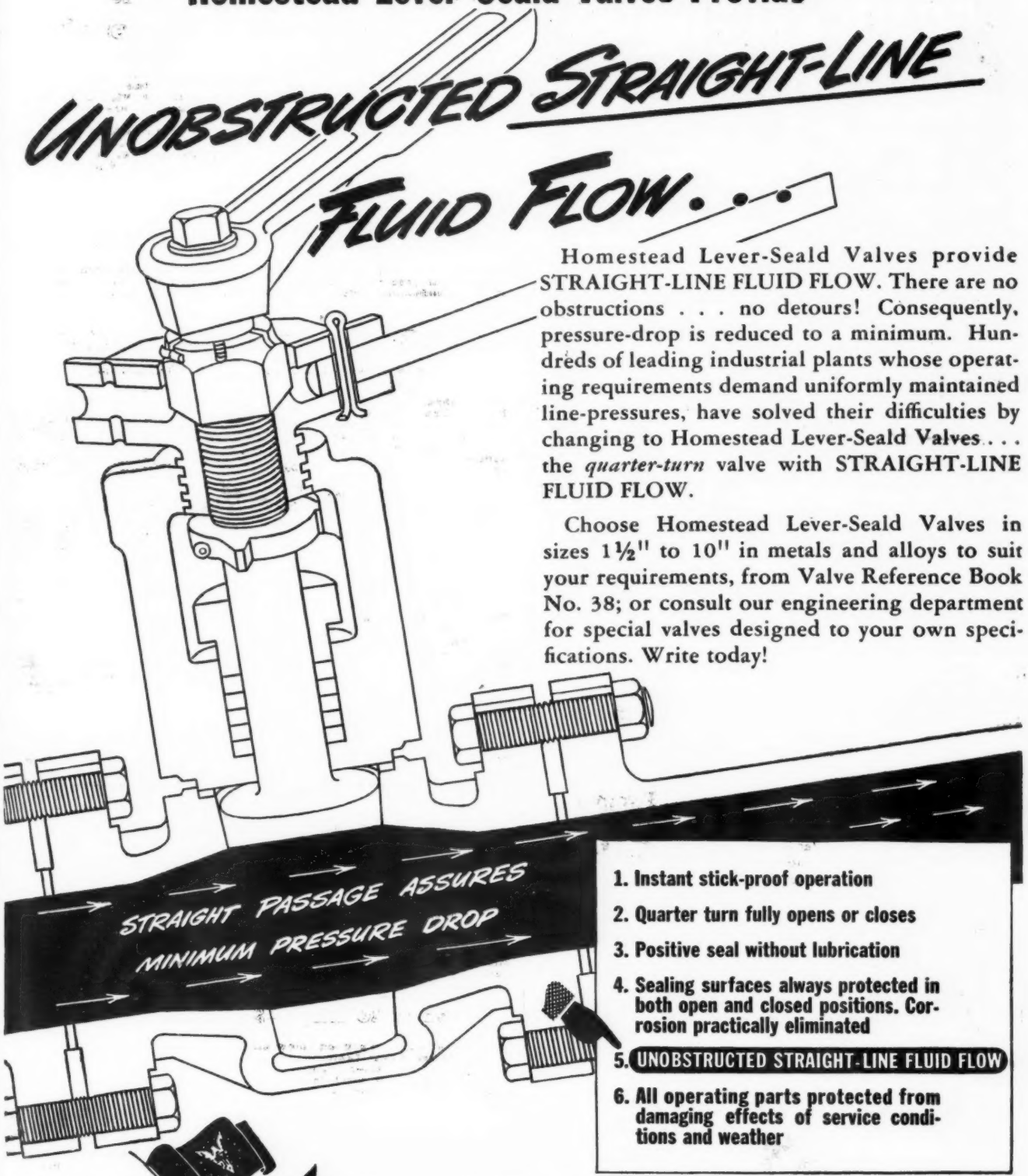
Homestead Lever-Seald Valves Provide

UNOBSTRUCTED STRAIGHT-LINE FLUID FLOW . . .



Homestead Lever-Seald Valves provide STRAIGHT-LINE FLUID FLOW. There are no obstructions . . . no detours! Consequently, pressure-drop is reduced to a minimum. Hundreds of leading industrial plants whose operating requirements demand uniformly maintained line-pressures, have solved their difficulties by changing to Homestead Lever-Seald Valves . . . the *quarter-turn* valve with STRAIGHT-LINE FLUID FLOW.

Choose Homestead Lever-Seald Valves in sizes 1½" to 10" in metals and alloys to suit your requirements, from Valve Reference Book No. 38; or consult our engineering department for special valves designed to your own specifications. Write today!

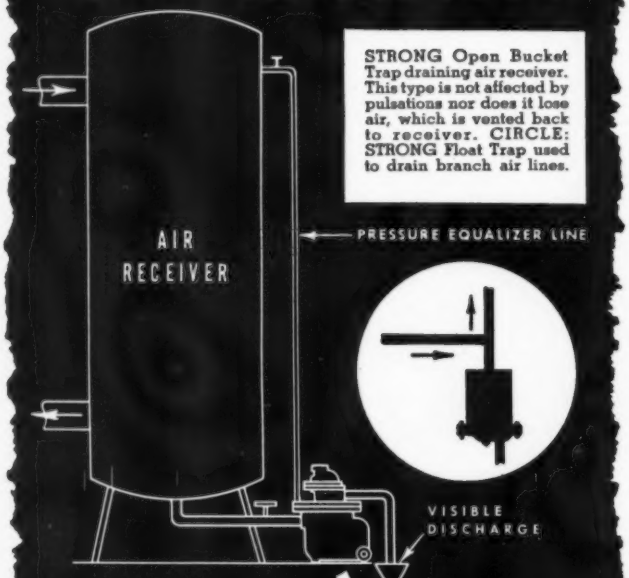
1. Instant stick-proof operation
2. Quarter turn fully opens or closes
3. Positive seal without lubrication
4. Sealing surfaces always protected in both open and closed positions. Corrosion practically eliminated
5. UNOBSTRUCTED STRAIGHT-LINE FLUID FLOW
6. All operating parts protected from damaging effects of service conditions and weather

Maritime's two-flag, highest production award to our men and women making valves for the Victory Fleet.

Homestead LEVER-SEALD VALVES

HOMESTEAD VALVE MFG. CO. · · · P. O. BOX 210 · · · CORAOPOLIS, PA.

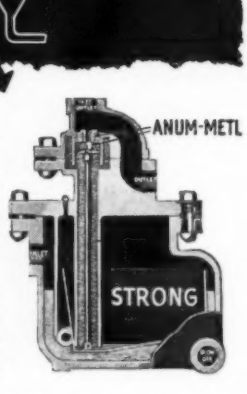
DRAIN RECEIVERS WITH NO AIR LOSS



STRONG Open Bucket Trap draining air receiver. This type is not affected by pulsations nor does it lose air, which is vented back to receiver. CIRCLE: STRONG Float Trap used to drain branch air lines.

Reciprocating compressors cause pressure surges in air receivers. These pulsations tend to "bounce" buckets of inverted bucket traps, resulting in excessive wear of parts, continual discharge and loss of air.

STRONG Open Bucket Traps are not affected by such pulsations. Only the weight of condensate in the bucket causes them to discharge. No air is lost during discharge, and air displaced from the trap by incoming condensate is vented back to the receiver.



This hook-up also is used for draining gas receivers and accumulators. Where liquids other than water are handled, special traps are furnished.

• • •

Completeness of the STRONG lines enable us to recommend exactly the type and size you need—open or inverted bucket, closed float, float-and-thermostatic (blast), etc.—forged, fabricated (welded), cast and semi-steel construction. Send your problems to Strong, Carlisle & Hammond Company, Cleveland, Ohio.

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Are you equipped to hold your job?—to get a new one?

The men who are keeping their jobs today—who are not feeling the whip of competition—are those who have kept one jump ahead of their jobs. They are the men who are equipped with a thorough-going and growing knowledge of the business they are in.

It works in the power plant field as well as in any other. Some men fit themselves to do a little more than their job calls for. They fit themselves to do a little more than the other fellow. They make a steady effort to equip themselves with the best kind of job insurance there is—KNOWLEDGE.

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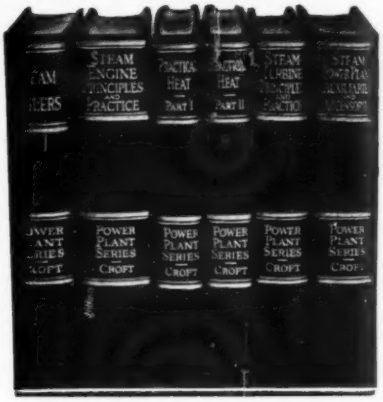
(6 volumes—2,477 pages, 2,404 illustrations)



The Library of Power Plant Practice is the standard of the power plant field. It is accurate — it is thorough — it is complete. It is the result of years of experience with power plant problems. The man who has it has the best. The Library covers the whole field—nothing is omitted. The solution of every problem is plainly worded or explained with a clear illustration. The little stickers and the big troublesome problems are all worked out in advance for you. There can be only one result from studying these books a few minutes each day — more money in your pocket.

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These books are written in everyday easy-to-understand language. They are written to help the man on the job. It is just as if the author were working in the plant by your side and giving you the benefit of his vast knowledge, man to man. There is no bunkum in this Library, nor is it cluttered up with impractical theories. It is a **Power Plant Library** FOR POWER PLANT MEN.

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COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*

Tubing Failure Avoided By Knowledge of Corrosion Causes

Bridgeport Research Reports Are Continued As Aid to Marine and Power Engineers

The necessary present-day restrictions on the use of metal makes it increasingly important for marine and power engineers to do everything possible to extend the service life and efficiency of condenser and heat exchanger tubes. This can be done more readily when the fundamental causes of corrosion are understood. An outline of the mechanisms of different types of corrosion was started in the last issue of the COPPER ALLOY BULLETIN. Reprints of this are available upon request. The following is a continuation of this information:

The rate of the reactions previously discussed is determined by the slowest of the reactions under a given set of conditions. For example, the reaction $M + H_2O \rightarrow MOH + H$ for iron is the fastest and the reaction $2H + O \rightarrow H_2O$ is the slowest under many commonly occurring conditions.

Effect of Oxygen

Several investigations have shown that the rate of corrosion in natural water is almost directly proportional to the oxygen content. In a closed system, such as a hot water heating system in a home, the corrosion becomes negligible after the oxygen has been gradually removed. The rate at which the reaction proceeds also depends upon the character of the metal, hydrogen ion concentration (called pH), temperature, etc.

Detecting Corrosion Products

The detection of the corrosion products (metal hydroxide, hydrogen or water) resulting from these reactions varies with the corroding metal or alloy and corrosive solution. The hydroxides of the active metals, for example sodium and potassium, are very soluble in water and will not reveal their presence for some time. The evolution of hydrogen, however, is very rapid and the reaction is violent. The hydroxides of the less active metal, such as iron, are only slightly soluble in water and quickly reveal their presence as white or reddish brown ferrous and ferric hydroxides.

The removal of metal ions from the solution by the formation of an insoluble or soluble corrosion product permits the reaction $M \rightarrow M^+ + e$ to go forward. Sometimes other materials present in the water coprecipitate with the slightly soluble hydroxides and form a more or less protective coating on the surface of the metal. A small quantity of dissolved carbon dioxide in water takes part in the formation of a practically insoluble green basic copper carbonate, such as is found in copper piping in service for some time, which greatly retards or stops the corrosive action.

Complex Salt Reactions

In the presence of salts, such as sodium chloride, the reaction $M + H_2O \rightarrow MOH + H$ becomes more complicated:

(7) $M + H_2O + NaCl \rightarrow MCl + NaOH + H$

(8) $MCl + NaOH \rightarrow MOH + NaCl$

(9) $M + HOH \rightarrow MOH + H$

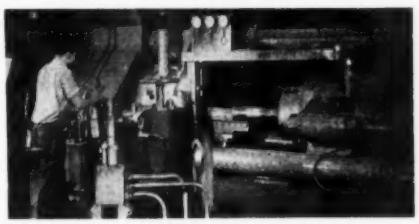
However, reactions (7) and (8) overlap so that a mixture or compound of metal hydroxide and chloride called a metal oxychloride is formed on the metal surface. In this instance, the reaction $2H + O \rightarrow H_2O$ still remains the controlling factor as already described.

Nature, Distribution of Corrosion Product Important

Both the nature and the distribution of the corrosion product formed on the metal surface have a tremendous influence on the rate of corrosion, it has been discovered as the result of extensive service and laboratory tests. For this reason a careful study of the reactions discussed furnishes a valuable clue to the proper selection of condenser tubes for service under various conditions, as well as to recognizing the reasons for tube failures. (The experience of Bridgeport condenser tubing engineers and laboratory engineers, gained both from experimental work and by investigating a large number of tubing installations throughout the country, is available to aid marine and power engineers in the solution of their particular corrosion problems.)

As has been seen, the corrosion product may be a solid impermeable or a permeable film with physical and chemical properties which are different from the metal being corroded. The corrosion films which form on metals are generally considered as belonging to two classes: the visible nonprotective films and the invisible protective films. There are in addition, of course, films which have characteristics between these two extremes.

(The discussion of corrosion causes will be continued in the next issue of this bulletin.)



A red hot billet of Bridgeport brass in position for extrusion into tubing. This extrusion press is typical of the powerful precision equipment now being used by Bridgeport to increase the scope of brass mill production.

Note: Bridgeport products are supplied in accordance with existing priority regulations.

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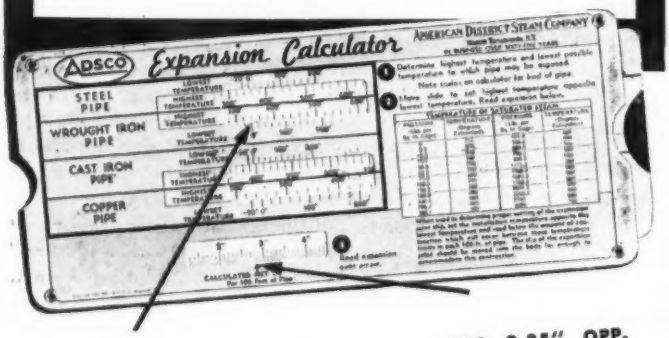
Example How to find expansion in 140 feet Wrought Iron Pipe with highest temperature corresponding to 100 lbs. steam pressure (by gauge) and lowest temperature 0°.

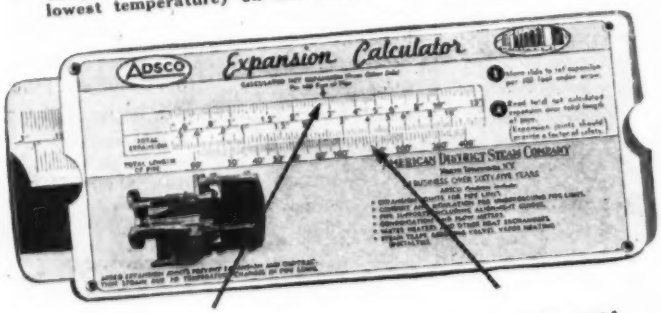


SET 3.40° OPP. 0°

Temperatures corresponding to 100 lbs. is a little less than 340° (340° = 103.3 lbs.) Set 340° (the highest temperature) on the slide opposite 0° (the lowest temperature) on the body.

READ 2.85" OPP. ARROW

Slot at bottom, opposite arrow reads 2.85 per 100 feet of pipe.



SET 2.85" OPP. ARROW

READ 4" OPP. 140' LENGTH

Turn calculator over. Set 2.85" (the expansion per 100 feet) on the slide opposite the arrow. Column marked "Total Expansion" reads 4" for 140 feet.

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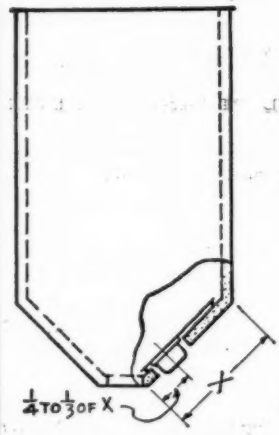

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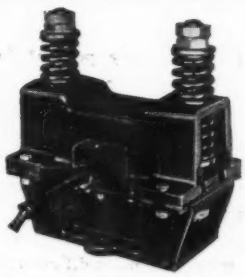

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Safeguards

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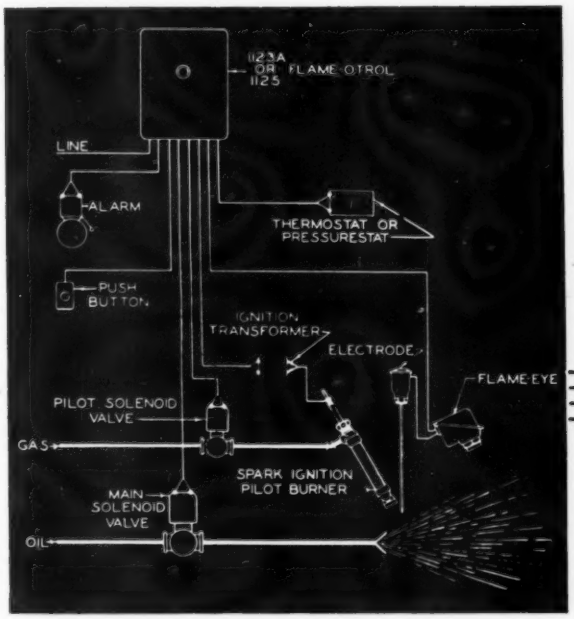

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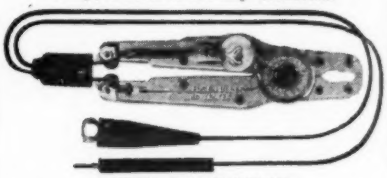

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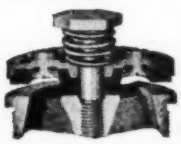

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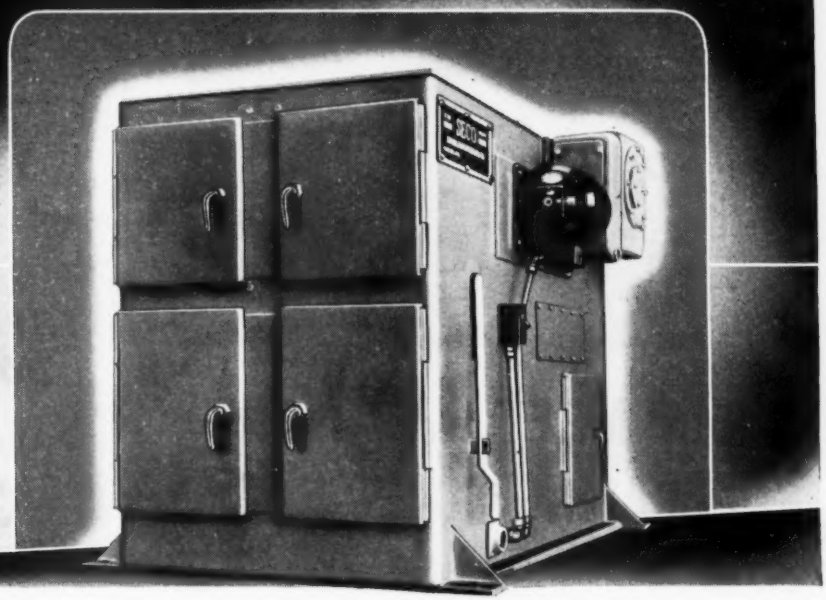

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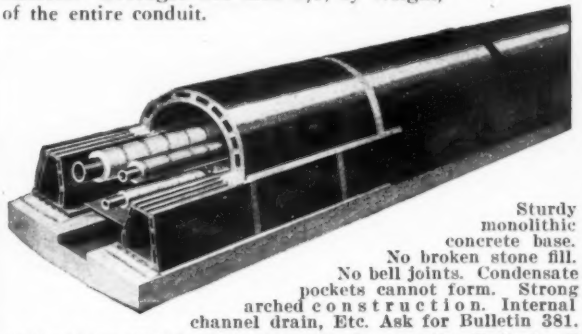

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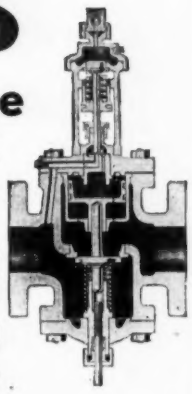

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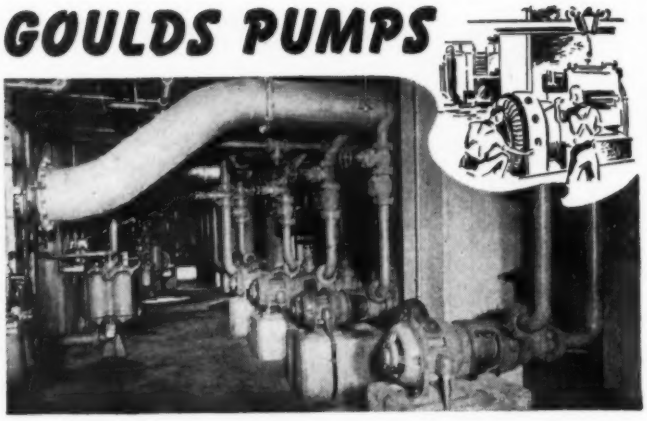

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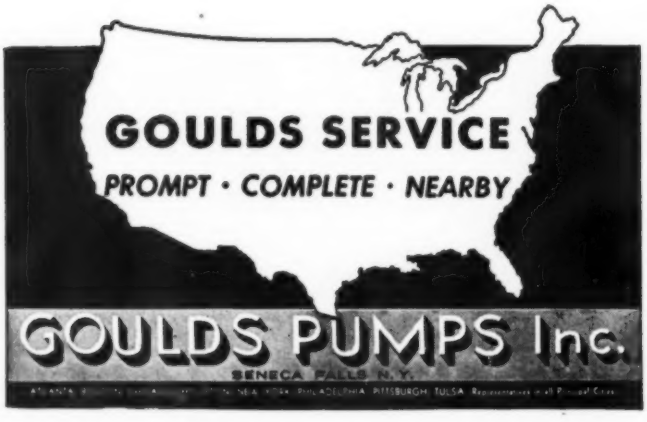

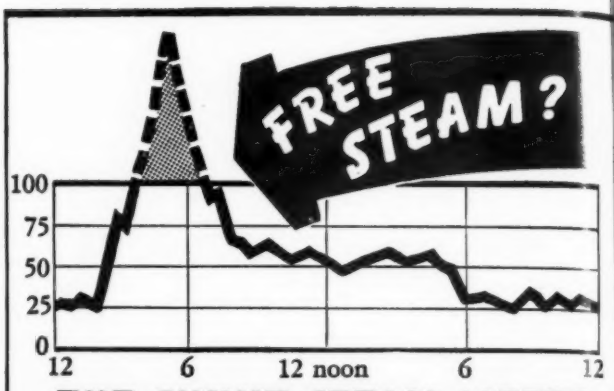

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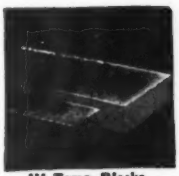

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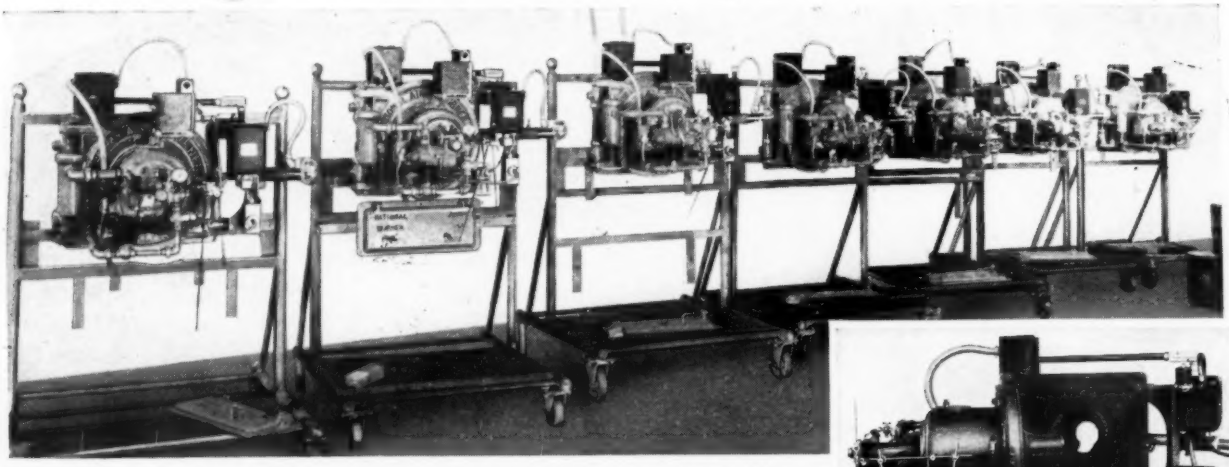

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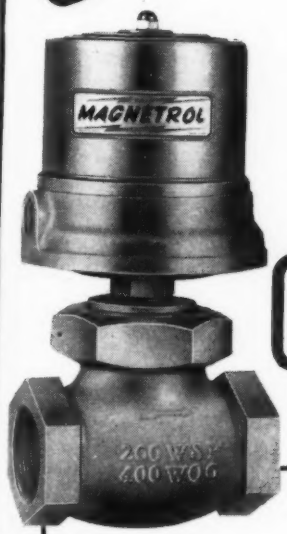

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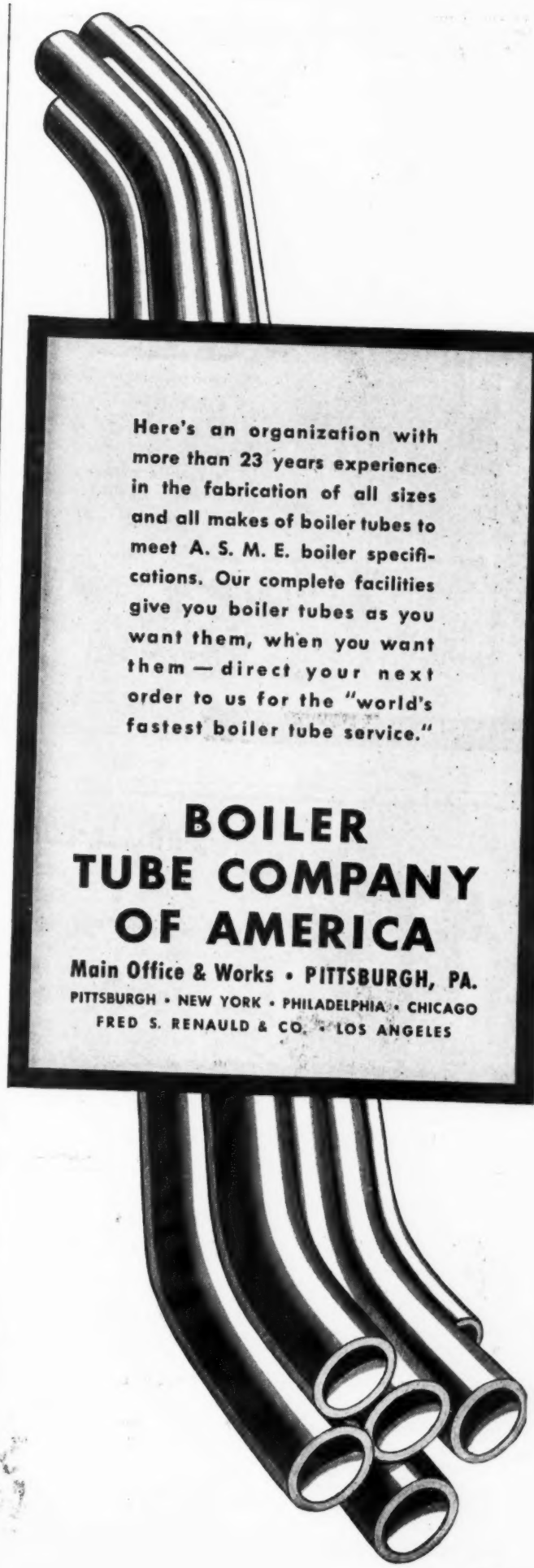

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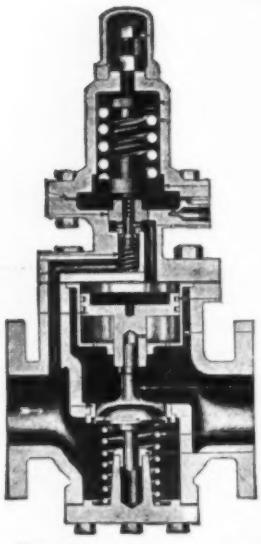

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K & M PILOT OPERATED REGULATING AND REDUCING VALVE—*providing dependable close regulation for any difficult reduction service. The pilot action assures accuracy regardless of inlet pressure variation. Shuts off tight in dead end service. Built for initial pressures up to 600 lbs.—with reduced pressure ranges of from 2 lbs. to 80% of the inlet pressure. Sizes 2" to 12".*

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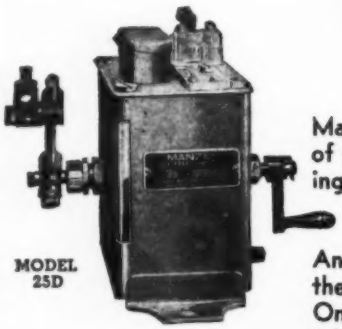

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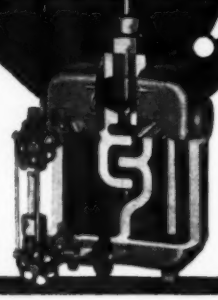

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YOU KNOW that repairs and maintenance costs will almost disappear as it has *not a single moving part*—

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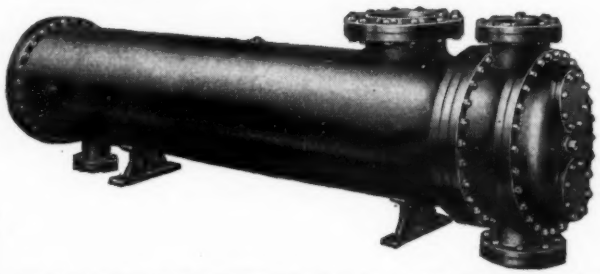

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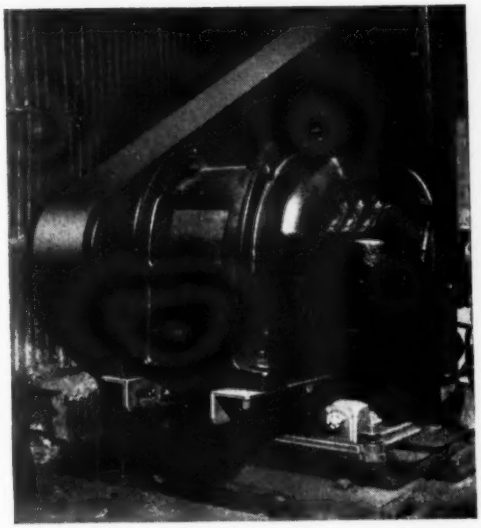

Use the Tannate-Rockwood drive . . . a consistent performer that keeps production flowing at a steady, high rate whatever the fluctuation in load.

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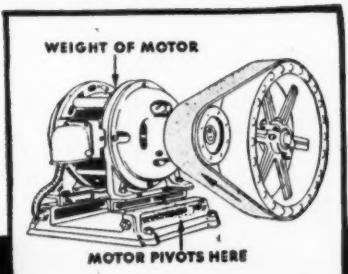

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PRODUCTION DRIVE

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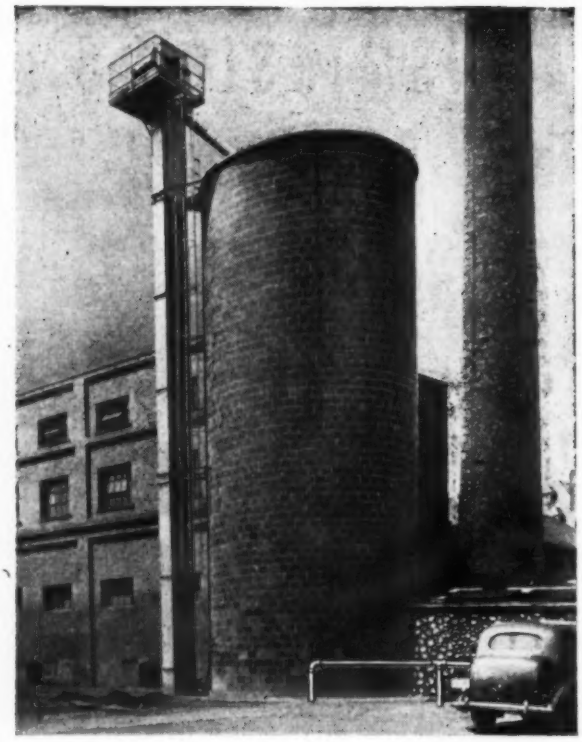

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If you think that conversion will require costly changes to your present buildings—we can set your mind at ease on this point—there are no changes necessary.

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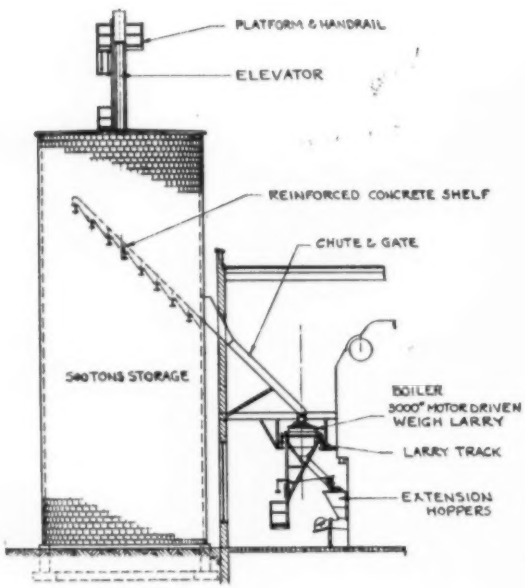

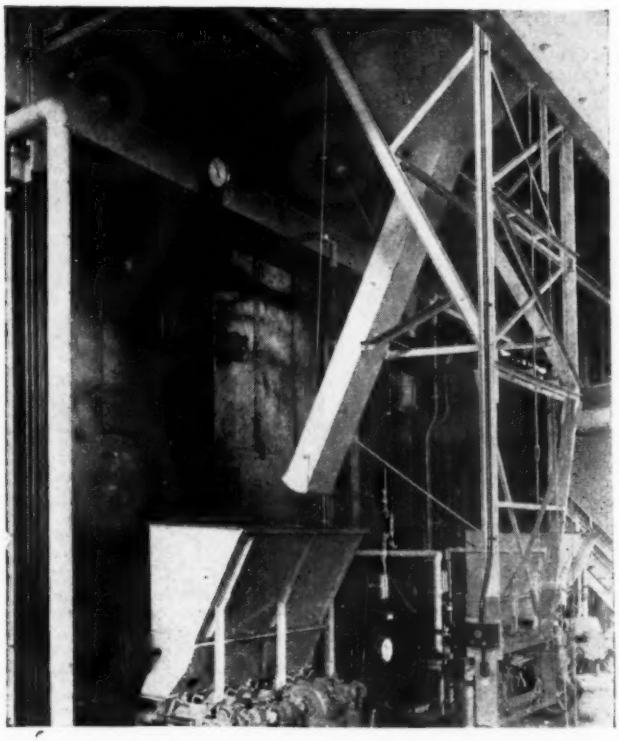

Fairfield will handle the entire installation from erection of Silo to complete handling of coal to storage and from storage to stokers.

Our catalog illustrates and fully describes a host of successful installations. Write for your copy today.

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ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
We will be pleased to quote prices on request.

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400 to 500 sq. ft. surface
Tubes good for 200 psi
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WANTED: Man as feed water analyst and assistant to superintendent of the University heating plant. State age, qualifications, and least salary in first letter to: University of Idaho, Heating Plant, Moscow, Idaho.

WANTED Designing and development engineer by an old established and substantial company. Must have experience and be capable of figuring jobs involving unit heaters, radiation, blast coils, refrigeration—and able to work out new developments on such equipment. Write complete qualifications in first letter. If now engaged in war work do not apply. Address P-567, Power, 330 W. 42nd St., New York 18, N. Y.

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SALARIED POSITIONS—This advertising service of 33 years' recognized standing negotiates for high salaried supervisory, technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R W. Bixby, Inc., 279 Delward Bldg., Buffalo. N. Y.

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POSITION WANTED—20 years experience as operating and chief engineer in Textile and Paper Mills. Past 45 years of age. Married. PW-536, Power, 330 W. 42nd St., New York, 18. N. Y.

POSITION WANTED—Has anyone an opening in their Power Plant that offers advancement and practical experience to a young man who likes Steam and is interested in his work. 30 years of age, draft exempt, and has 5 years experience as fireman on H.P. stationary boilers. Graduate in Combustion Engineering; excellent references. PW-564, Power, 330 W. 42nd St., New York, 18, N. Y.

CHIEF ENGINEER, (41) 22 years' experience operating steam engines and turbines, oil and coal-fired high-pressure boilers, refrigerating and air-conditioning equipment in stationary and marine power plants. Machine-shop experience. Available on one month's notice. PW-566, Power. 330 W. 42nd St., New York, 18. N. Y.

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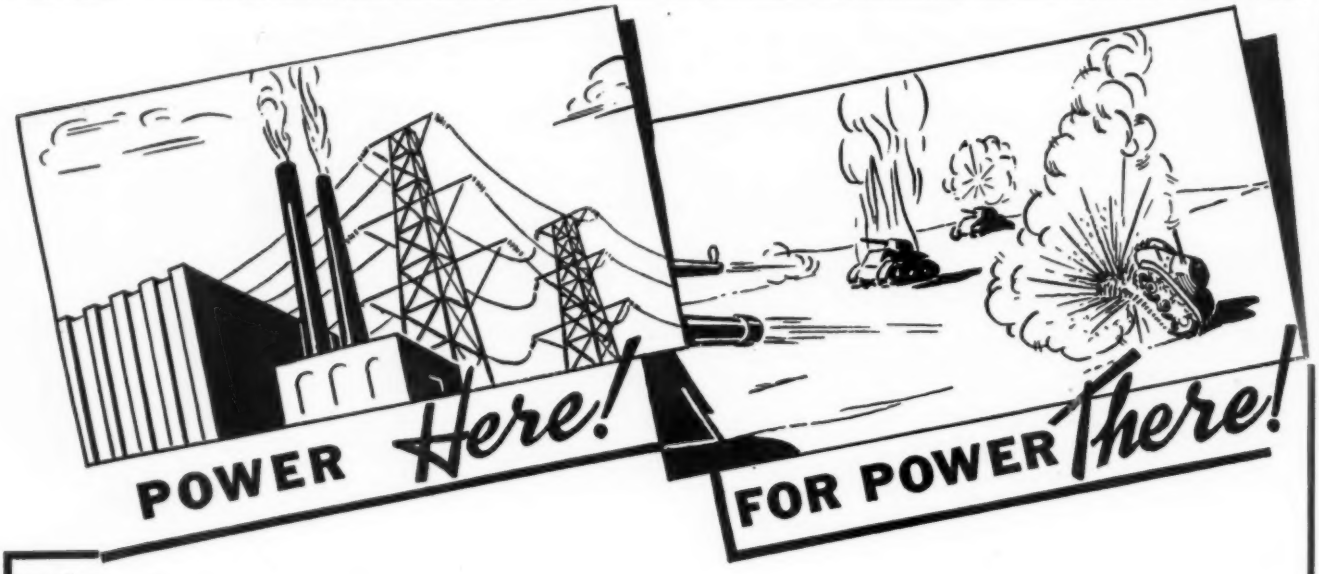

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1—2000 ampere, 6 volt, Hanson-Van Winkle
1—1500 ampere, 6 volt, Hanson-Van Winkle
1—750 KW, 250 volt, Allis Chalmers synchronous
1—75 KW, 125 volt, Crocker-Wheeler synchronous
1—35 KW, 125 volt, Electric Machinery squirrel cage induction motor.
1—20 KW, 600 volt, General Electric squirrel cage induction motor.

ALTERNATORS

1—526 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—62½ KVA, 3600 RPM, 220 volts, Allis Chal.

MOTORS—3 PHASE 60 CYCLE

1—400 HP, 514 RPM, 440 volt, Westg., slip ring.
1—335 HP, 600 RPM, 2300 volt, G.E., syn.
1—300 HP, 720 RPM, 2200 volt, G.E., slip ring.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E., Sync.
1—200 HP, 600 RPM, 2200 volt, G. E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
1—150 HP, 1800 RPM, 440 volts, General Electric, squirrel cage.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
1—150 HP, 720 RPM, 440 volt, G.E., sl. rg.
1—150 HP, 600 RPM, 440 volt, G.E. sl. rg.
1—150 HP, 400 RPM, 440 volt, G.E. sq. cg.
2—125 HP, 720 RPM, 440 volt, G.E., sl. rg.
1—100 HP, 900 RPM, 440 West., sq. cg.
1—100 HP, 900 RPM, 440 volt, G.E., sl. rg.
3—100 HP, 720 RPM, 440 volt, G.E., sl. rg.
1—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., sl. rg.
1—100 HP, 600 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 514 RPM, 440 volt, G.E., sq. cg.

INSTRUMENTS

25—Westinghouse type U Recording Ammeters with slit core, CT.

25—Westinghouse type U Recording Voltmeters.

MOTORS—3 PHASE 60 CYCLE (Con't)

2—100 HP, 450 RPM, 440 volt, G.E., sq. cg.
1—90 HP, 400 RPM, 550 volt, Cr. Whlr., sq. cg.
1—75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
1—75 HP, 900 RPM, 220 volt, Fairbanks Morse, slip ring.
1—75 HP, 900 RPM, 440 volt, G.E., sq. cg.
1—75 HP, 720 RPM, 440 volt, Westghse., slip ring.
1—75 HP, 720 RPM, 440 volt, G.E., sq. cg.
2—75 HP, 1200 RPM, 2200 volt, G.E., Vertical.
1—50 HP, 900 RPM, 440 volt, G.E., sl. rg.
1—50 HP, 900 RPM, 440 volt, G.E., sq. cg.

MOTORS—D.C. 230 VOLTS

2—450 HP, G.E., 400 RPM, Type MPL, Form 1-F.
1—250 HP, 760 RPM, Electro Dynamic.
2—150 HP, Westghse., 550 RPM, Type SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1—80 HP, Crocker-Wheeler, 600 RPM, Type CMC.
1—75 HP, G.E., 575 RPM, Type C, Sprague; with spare armature.
1—65 HP, 1000 RPM, G.E., Type RC.
8—50 HP, Crocker-Wheeler, 700 RPM, Type CM.
1—65 HP, G.E., 625 RPM, Type DLC-65, Form A.
1—50 HP, 750 RPM, Westghse., Type SK.
1—50 HP, 700 RPM, Crocker-Wheeler.
1—40 HP, G.E.-Sprague, 700 RPM, Type LC.
1—40 HP, 775 RPM, Westinghouse.
1—40 HP, 300 RPM, G.E.
1—30 HP, 750 RPM, G.E., type RC.
1—30 HP, G.E., 750 RPM, Type RC-14, Form A.
1—30 HP, G.E., 1100 RPM, Type RC-31B, Form A-21.
1—35 HP, G.E., 650 RPM, Type RC-15.
1—30 HP, G.E., 625 RPM, Type C.
1—25 HP, Westghse., 600 RPM, Type SK.
2—25 HP, G.E., 775 RPM, Type RC-13.
1—20 HP, G.E., 800 RPM, Type RC-12, Form A.
2—20 HP, Westghse., 1700 RPM, Type SK.
1—15 HP, G.E., 800 RPM, Type RC-11.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—250 KVA, G.E., 6600/2200/220/440.
3—200 KVA, G.E., 2200/220/440.
3—150 KVA, G.E., 33,000 2300/4000 Y.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—75 KVA, G.E., 13,500-750/440 volts.
1—75 KVA, G.E., 3 phase, 4156Y—120/208Y.
3—50 KVA, Wagner, 4150-220 volts.
2—50 KVA, Pbgh. 7500/15000 volts-110/220 volts.
4—37½ KVA, 2200-220/110 v.
7—25 KVA, Westg., air cooled, 440/220-110 volts.
1—25 KVA, G.E., 220/110-220/110 volts.
2—15 KVA, G.E., 2300-115/230 volts.

MOTORS—VARIABLE SPEED 230 VOLTS

2—100 HP, 475/1375 RPM, Electro Dynamic.
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—60 HP, 600/1200 RPM, General Electric.
1—35 HP, 500/1500 RPM, Westinghouse.
1—35 HP, 350/1050 RPM, Electro Dynamic.
1—30 HP, 225/900 RPM, Crocker Wheeler.
7—25 HP, Westinghouse, 650/2200 RPM, Type SK-110L.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

TURBO-GENERATORS

600 KW Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westghse., non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v., cond.
1—200 KW, G.E. 3 ph., 60 cy., 220 v., cond.

Hemphill FOR POWER

J. L. HEMPHILL & COMPANY

1602 53rd ST., NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227 NEW JERSEY—UNION 3-2600

ELECTRICAL POWER EQUIPMENT

ROTARY CONVERTERS

3 phase 60 cycle

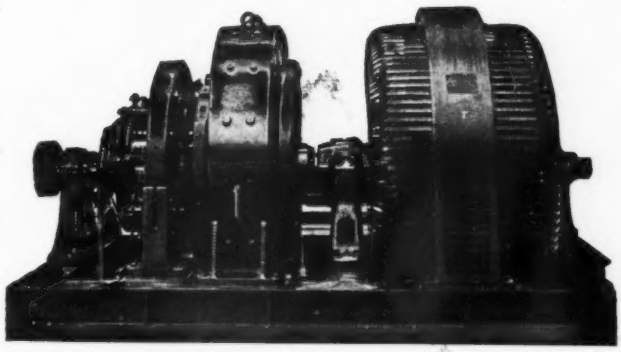
3500 KW (2) WESTINGHOUSE 225-285 volts D. C., 225 RPM, with 13200 volt transformers

1500 KW WESTINGHOUSE 225-285 volts D. C. 450 RPM, with 2300/4000-6900/12000 volt transformers

1000 KW WESTINGHOUSE 250 volts D. C., 600 RPM with 22000 volt transformer

750 KW GENERAL ELECTRIC 600 volts D. C., 1200 RPM, with 2300/4000 volt transformers

400 KW (2) GENERAL ELECTRIC 125/250 volts 3-wire D. C., 600 RPM with 2300 volt transformers



Actual Photograph

1000 KW GENERAL ELECTRIC MOTOR GENERATOR SET

1000 KW (1250 KW 2 hrs. 55 deg. C rises) GENERAL ELECTRIC direct current generator 125/250 volts 3-wire 720 RPM direct connected to 1400 HP 80% P.F. (1750 HP 2 hours 55 deg. C rise) GENERAL ELECTRIC synchronous motor 3 phase 60 cycle 13200/6600 volts 720 RPM. Equipped with D.C. breakers.

MOTOR GENERATOR SETS

3 phase 60 cycle

1000 KW GENERAL ELECTRIC synchronous 125/250 volts 3-wire D. C., 13200/6600 volts A. C., 720 RPM

1000 KW GENERAL ELECTRIC 3-UNIT synchronous 125/250 volts D. C., 4000/2300 volts A. C., 720 RPM

800 KW WESTINGHOUSE 3-UNIT synchronous 250 volts D. C., 4000 volts A.C., 400 RPM

500 KW GENERAL ELECTRIC synchronous 700 volts D. C., 4150 volts A.C. 720 RPM

500 KW GENERAL ELECTRIC synchronous 250 volts D. C., 4000 volts A.C. 900 RPM

Steam Turbo Generators

3 phase 60 cycle

3750 KVA GENERAL ELECTRIC 200 lbs. 2300/4000Y volts with surface condenser.

3125 KVA GENERAL ELECTRIC 225/400 lbs. 2400/4160 volts, with surface condenser

1875 KVA GENERAL ELECTRIC 150 lbs. 2300 volts with surface condenser

1250 KVA ALLIS CHALMERS 150/200 lbs. 2300 volts with jet condenser

940 KVA WESTINGHOUSE 250 lbs. 6600 volts with surface condenser

625 KVA (3) GENERAL ELECTRIC bleeder, 150 lbs. 10 lbs. bleeder pressure, 240 volts with jet condensers

625 KVA (2) ALLIS-CHALMERS KERR non-condensing, 90 lbs. 10 lbs. back pressure, 480 volts

Steam Engine Generators

3 phase 60 cycle

675 KVA GENERAL ELECTRIC-AMES uniflow, 150 lbs. 5 lbs. back pressure, 240/480 volts

500 KVA ALLIS CHALMERS Corliss, 175 lbs. 25 lbs. back pressure, 240/480 volts

438 KVA GENERAL ELECTRIC-SKINNER uniflow, 150 lbs. 5 lbs. back pressure, 240/480/2300 volts

300 KVA GENERAL ELECTRIC-AMES twin uniflow, 175 lbs. 10 lbs. back pressure 240/480 volts

210 KVA GENERAL ELECTRIC-SKINNER uniflow, 150 lbs. 5 lbs. back pressure 240/480/2300 volts

SURFACE CONDENSER

1540 sq.ft. WORTHINGTON surface condenser with steam jet air pumps

Diesel Engine Generators

3 phase 60 cycle

333 KVA GENERAL ELECTRIC DE LAVERGNE 4 cylinder 2300 volts, 225 RPM

250 KVA (4) CROCKER WHEELER WORTHINGTON 6 cylinder 208/120 volts, 400 RPM

200 KVA FAIRBANKS-MORSE 4 cylinder 2400 volts, 257 RPM

170 KVA FAIRBANKS-MORSE 4 cylinder 2400 volts, 257 RPM

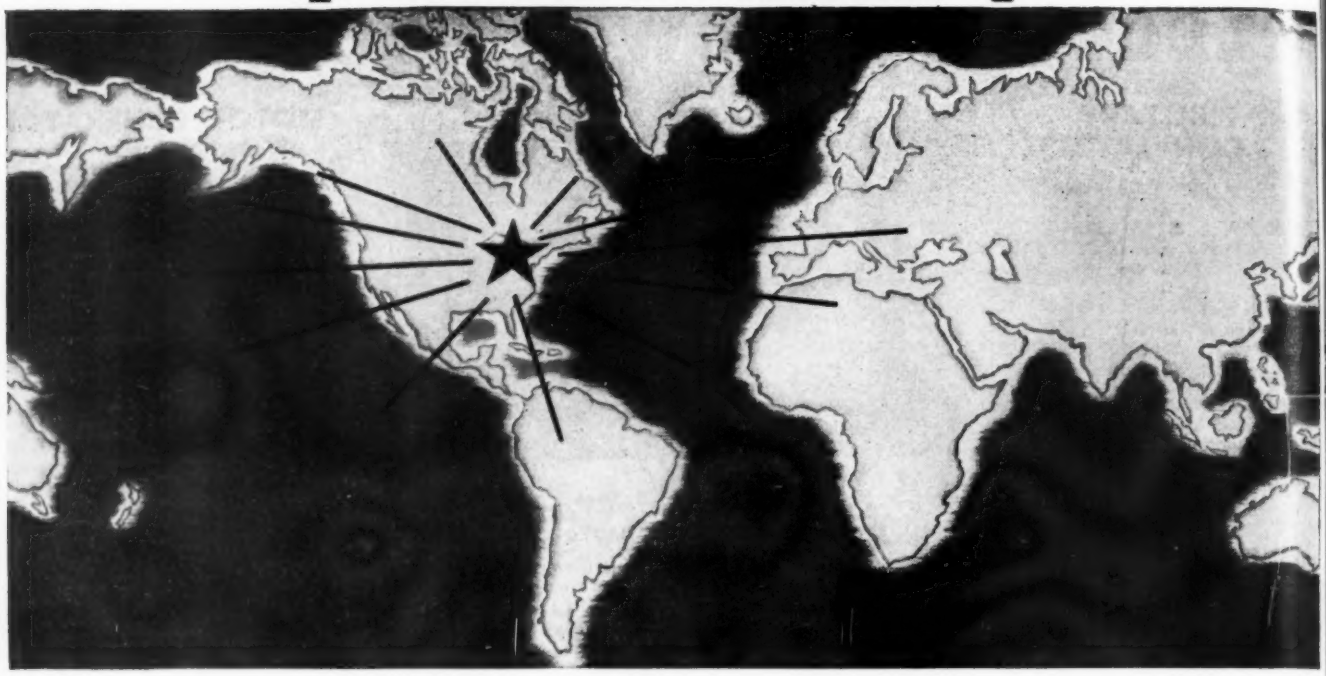
150 KVA WESTINGHOUSE WORTHINGTON 3 cylinder 480 volts 327 RPM

121 KVA FAIRBANKS-MORSE 2 cylinder 240 volts 300 RPM

57.7 KVA FAIRBANKS MORSE 1 cylinder 240 volts 300 RPM

49½ KVA FAIRBANKS MORSE 6 cylinder 2400 volts 1200 RPM

THE NATIONAL POWER MACHINERY CO.
1921 SCRANTON ROAD CLEVELAND, OHIO



SO VICTORY WILL SPROUT IN MANY LANDS . . .

The seeds of victory are machines for production. O'Brien has rebuilt and supplied thousands of machine tools and operating equipment items to American war plants. What could be spared has been sent abroad —to American and United Nations' possessions. Wherever O'Brien machinery is at work, here at home or in friendly foreign lands, you may be sure its fruits will help bring a united and final victory.

MOTOR GENERATOR SETS

1000 K.W. G.E., 3 unit, 135/270 V, 1400 H.P., Synchronous 3/60/2300/514 RPM
750 K.W. G.E., 4 unit, 240/240/240/1200 RPM, 1200 HP Synchronous 3/60/2300
500 K.W. G.E. MPC, 250 V, 700 KVA, 3/60/2300
250 K.W. G.E. MPC, 240 V, 1200 RPM, 3/60/2300
200 K.W. G.E. DLC, 240 V, 3/60/2300/720 RPM
200 K.W. Ridgway 250 V, 3/60/4000/900 RPM
150 K.W. Ridgway 250 V, 3/60/2300/900 RPM
100 K.W. G.E. Syn. Drive 250 V, 3/60/220/1200
100 K.W. West. 125 V, 3/60/2300 Sq. Cg.
75 K.W. G.E. Sq. Cg. 250 V, 3/60/2300
50 K.W. G.E. RC Syn. Drive 125 V, 3/60/220/1200 RPM
50 KVA G.E. 3/60/220 75 H.P. Drive 125 V.
50 K.W. West. 150 V, Syn. Drive 3/60/220
50 K.W. G.E. 125 V, Sq. Cg. 3/60/2300/720 RPM
35 K.W. Fairbanks-Morse 240 V, Syn. Dr. 3/60/220
10 K.W. Crocker Wheeler Balancer 125 V
5 K.W. G.E. 125 V, 3/60/220/1800 RPM

STEAM ENGINE GENERATOR SETS

Alternating Current

1000 KVA West. Skinner Uniflow 3/60/440
750 KVA. G.E.—Skinner Uniflow 3/60/2300
400 KVA Allis-Chalmers Corliss 3/60/480
375 KVA West.—Skinner Uniflow 3/60/440
325 KVA G.E.—Chuse Uniflow 3/60/220/2300
300 KVA G.E.—Ames Uniflow 3/60/480
210 KVA G.E.—Skinner Uniflow 3/60/480
200 KVA Allis-Chalmers—Ames Uniflow 3/60/240
187 KVA G.E.—Chuse Uniflow 3/60/240
125 KVA G.E.—Chuse 4 valve 3/60/240
50 KVA West.—Harrisburg Automatic 3/60/220/2300

STEAM TURBINE GENERATOR SETS

Condensing—A.C.

1—4000 KVA Allis Chalmers 3/60/2300/3600 RPM
1—3125 KVA Gen. Elec. 3/60/2300/3600 RPM
1—1500 KVA Westinghouse 3/60/2300/3600 RPM
1—1250 KVA Gen. Elec. 2/60/2300/3600 RPM
1—937 KVA Gen. Elec. 3/60/2300/3600 RPM
3—625 KVA Allis-Chalmers 3/60/2300/3600 RPM
1—625 KVA Gen. Elec. 2/60/2300/3600 RPM
1—500 KVA West. Geared, 3/60/2400/6000—900 RPM
3—500 KVA Gen. Elect. Bleeder 3/60/220/3600 RPM
1—250 KVA Worthington Moore Bleeder 3/60/220
1—187 KVA Westinghouse geared 3/60/2300
1—150 KVA Westinghouse 3/60/240/3600 RPM

Non-Condensing—A.C.

1—625 KVA Westinghouse geared 3/60/2300
1—625 KVA Allis-Chalmers 3/60/240/3600 RPM
1—500 KVA G.E.—Terry 3/60/120/208/3600 RPM New
1—500 KVA Westinghouse geared 3/60/480 New
1—375 KVA Westinghouse geared 3/60/2300
1—375 KVA Allis Chalmers 3/60/240/3600 RPM
1—125 KVA Al. Ch.—Kerr 2/60/220/3600 RPM
1—75 KVA Allis-Chalmers 3/60/240/3600 RPM

A. S. M. E. BOILERS

1—500 H.P. Keeler-Wetzel Stoker, 160 lbs.
1—400 H.P. Babcock Wilcox W.T. 200 lb. W.P.
1—300 H.P. Brady Scotch Marine 15 lb.
2—300 H.P. Heine non code, 160 lb.
2—250 H.P. Union Water Tube—Taylor Stokers
2—250 H.P. International self-contained, 200 lbs.
3—150 H.P. Wickes H.R.T.—Combustion Stokers, 150 lbs. New 1934.
1—100 H.P. Babcock & Wilcox W.T. 350 lbs. W.P.

Everything from a Pulley to a Power House

THE O'BRIEN MACHINERY CO.

PHILADELPHIA'S LARGEST MACHINERY DEALERS AND EXPORTERS

113 NORTH THIRD STREET • PHILADELPHIA - PENNA.

BELL TELEPHONE: MARKET 4180 CABLE ADDRESS: OBRIEN-PHILA

Immediate Shipment for Quick Victory and Total Peace under Highest War Production Board Allocation only

TURBOS—60 cycles

15000 KW capacity condensing, non-automatic bleeder (approved 275# 550° t.t.) volume extraction at either 100 or 65# g.b.p. Elspecs 60/3/standard voltage. Complete going unit including surface condenser, all auxiliaries and piping.

•

3—5000 KW 80% nominal, 7200 KVA range, 225# I.S.P. Elspecs 60/3/2300/3600. High percentage original full strength, otherwise necessary blading in stock.

2—3125 KVA Multi-Stage Condensing 60/3/2300/3600. One complete with surface condenser lay out and all standard auxiliaries for complete installation; One now with jet condenser, but liberal capacity surface condenser available from other stores.

3—2000 KW 80% nominal, 2500 KW approved range 60/3/1-440, 2-2300, condensing design and approved for non-condensing.

•

Several 300, 500, 750, 1000, 1200 and 1500 KW condensing standard pressure, also mixed pressure design.

•

TURBOS—25 cycles

50,000 KW total aggregate capacity, unit sizes of 3,000, 6,000 to 20,000 KW surface condenser equipped complete going units. High percentage full strength.

SURFACE CONDENSERS

8250, 11000, 12000, 15000 and 20000 sq. ft. surface condenser units complete. Log service on pure clear water. Condition sound.

WATER TUBE BOILERS

2—350# ASME 80,000/120,000# t.s.g. cross drum units, underfeed stoker equipped.

WATER TUBE BOILERS (Con't)

2—350# ASME 80,000/120,000# t.s.g. bent tube design, powdered fuel fired; one complete with boiler house stack, all auxiliaries, completely rebuilt and never operated.

•

4—1000 HP Steel Header Longitudinal Drum Type Water Tube Boilers 250# ASME Code design, and verified in recent inspection for re-erection. Now oil fired.
A complete going boiler station including modernly designed self-supported steel structure, and all standard boiler plant auxiliaries, piping, etc.
Approximately 2½ to 3 years each total log hours service.

•

3—700 HP 160,000# t.s.g. straight tube box steel header 200# ASME, without firing equipment.

•

8—400 HP 200# ASME bent tube design, superheaters, soot blowers, fans, heaters, coal and ash handling paraphernalia, etc. Also complete steel building.

•

12—200/500 HP straight and bent tube 200# units.

STOKERS

50 underfeed ram type stokers now operating in 11 retort per boiler layout under 700,000# t.s.g. units. Clinker grinders, fans and other auxiliaries available. All now under dismantling schedule.

•

LARGE POWER TRANSFORMERS

50,000 KVA O.I.W.C. transformers 150,000/135,000 delta—41,600/36,400; or 72,000/63,000 star.

•

9000 KVA transformers, as above.

•

15,000 KVA O.I.W.C. 60,000/54,000—18,000/9000.

•

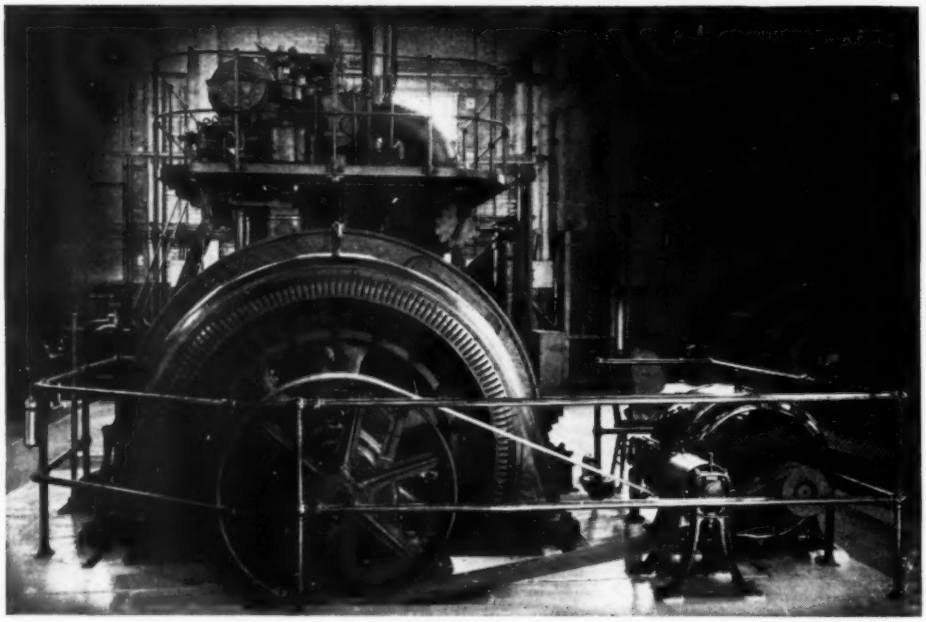
12,000 KVA O.I.W.C. transformers, 16,000 through 12,000, 500 and 250 KVA unit sizes, 75,000/43,000—2300 and other standard voltage ratios.

Complete data available on request.

"SQUARE COOPERATION IN HEAVY POWER THRU THREE WARS"

"May we confirm the record with you, face to face?" . . . P.S.

450 KVA DIESEL ENGINE-GENERATOR UNIT



ACTUAL PHOTOGRAPH

AVAILABLE IMMEDIATE DELIVERY

450 KVA General Electric; 2 or 3 phase, 60 cycle, 2300/550/440 volts, 200 RPM alternating current generator direct connected to Busch-Sulzer vertical full Diesel engine complete with auxiliaries. A#1 operative condition—still on original foundation for operating test.

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

7500 KVA Westinghouse condensing 200 lb. pressure, 2300 volts, 1800 RPM complete with either surface or jet condenser.

6250 KVA Westinghouse condensing 175-200 lb. pressure, 2300 volts, complete with surface condenser.

3125 KVA—2500 KW 80% P.F., G.E. 2300 volts, 3600 RPM, 180-200 lbs. pressure, 500 degree total temperature, equipped with surface condenser, condensing auxiliaries, panels and instruments. A complete installation.

1875 KVA G.E. condensing 175-200 lb. pressure, 500° T.T., 6600 volts, 3600 RPM complete with condenser.

937 KVA Allis condensing 150-200 lb. pressure, 475° T.T., 2300 volts, 3600 RPM complete with direct connected exciter, surface condenser and auxiliaries.

625 KVA G.E. condensing 200 lb. pressure, 2300 volts, 3600 RPM complete with condenser and auxiliaries.

375 KVA G.E. condensing 150-200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with surface condenser and auxiliaries.

375 KVA (2) G.E. non-condensing, 150-175 lb. pressure, 5 lb. back pressure, 2300 volts, 3600 RPM each complete with direct connected exciter.

125 KVA G.E. non-condensing, 110-125 lb. pressure, 0-10 lb. back pressure, 240 volts, 3600 RPM complete with switchboard.

ENGINE-GENERATOR UNITS

Direct Current

1000 KW Westinghouse, 250 volts, 514 RPM generator direct connected through reduction gear to Westinghouse condensing turbine, 150-200 lb. pressure, equipped surface condenser.

600 KW Crocker-Wheeler, 250 volts, 300 RPM generator direct connected to a 14" x 18", 4 cylinder Ames vertical Unaflow non-condensing engine, 150-175 lb. pressure, 5 lb. back pressure, complete with switch board.

400 KW G.E. 125 volts, 165 RPM generator direct connected to a 26" x 28" Elliott Ridgway Unaflow non-condensing engine.

300 KW Westinghouse, 250 volts, 175 RPM generator direct connected to a 24" x 26" Skinner Unaflow non-condensing engine.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle—Alternating Current

438 KVA G.E. 480 volts, 200 RPM generator direct connected to a 23" x 24" Skinner Unaflow non-condensing engine, 125-160 lb. pressure, 5 lb. back pressure. Complete installation.

312 KVA Elliott 4000/2300/550 or 240 volts, 180 RPM generator direct connected to a 17" x 24" Elliott Unaflow non-condensing engine, 175 lb. pressure, 6 lb. back pressure.

210 KVA G.E. 480 volts, 225 RPM generator direct connected to Skinner Unaflow engine.

MOTOR GENERATOR SETS

1500 KW Allis-Chalmers, 600 or 275 volt direct current generator direct connected to 2190 HP, 3 phase, 60 cycle, 4000/6600 volt, 300 RPM synchronous motor.

100 KW Triumph 250 volt direct current generator direct connected to 150 HP, 3 phase, 60 cycle, 2300 volt, 900 RPM squirrel cage motor.

MOTORS

—3 phase, 60 cycle

1500 HP Allis-Chalmers, 2,300 volts, 200 RPM slip ring.

625 HP G.E. type ATI, 22000 volts, 257 RPM synchronous.

620 HP G.E. type ATI, form S, 440 volts, 164 RPM synchronous.

250 HP (2) G.E. form M, 440 volts, 450 RPM three bearing slip ring.

150 HP (5) G.E. form K, 2200 volts, 580 RPM squirrel cage.

125 HP 80% P.F. Elec. Mchy. 440 volts, 400 RPM synchronous.

50 HP G.E. type I, form M, 2200 volts, 1200 RPM slip ring.

50 HP Allis-Chalmers, 440 volts, 600 RPM squirrel cage.

MISCELLANEOUS

1200 KVA G.E. 3 phase, 60 cycle, 2400 volts, 300 RPM alternating current generator direct connected to a 1700 HP, 3 phase, 25 cycle, 2300 volt synchronous motor.

MISCELLANEOUS

(Continued)

522 HP water tube boiler ASME code, 210 lb. pressure complete with stoker and accessories. New 1927.

500 KVA G.E. 3 phase, 60 cycle, 2300 volt, 450 RPM belted generator.

500 KVA Ideal, 3 phase, 60 cycle, 240 volt, 400 RPM belted generator with direct connected exciter.

330 KW G.E. synchronous rotary converter 600 volt direct current—6 phase, 60 cycle alternating current —1200 RPM with 2300 to 408 volt transformers.

200 KVA Westinghouse 3 phase, 60 cycle, 240 volt, 200 RPM engine type generator.

30 KW G.E. 125 volt, 625 RPM, type RC compound wound direct current generator.

1055 cu.ft. 100 lb. air pressure Chicago Pneumatic horizontal compressor direct connected to 170 HP, 240 volt, 150 RPM G.E. direct current motor.

SYNCHRONOUS CONDENSERS

1350 KVA

Total Capacity

750 KVA and 600 KVA G.E. type ATI, 3 phase, 60 cycle, 240 volts, 900 RPM synchronous condensers each complete with direct connected exciter, switchboard panel with instruments. Are in A#1 operative condition — still on original foundation for operating test.

Utilities Electrical Machinery Corporation

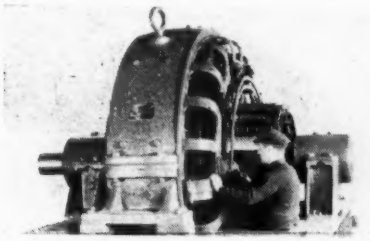
600 NATIONAL CITY BANK BLDG.
CLEVELAND, OHIO

WIRE OR PHONE
LONG DISTANCE 422

Step Up Your Power

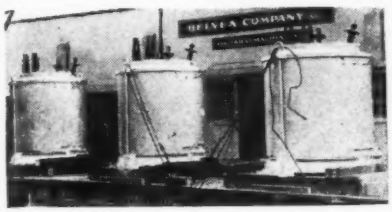
QUICK WITH

STOCK EQUIPMENT



Shipped as fast as conditions allow

WRITE—Better Still—WIRE



MOTOR GENERATOR SETS

3 Phase 60 Cycle

1—1500 KW G.E., 600 V. D.C. to 2100 H.P. 6600 V.
1—1000 KW G.E., 250 V. D.C. to 1400 H.P. 11000/2300 V.
1—500 KW 3 unit consisting of 2—250 KW G.E., 250 V., d.c., to 1—700 HP, 2300 V.
1—500 KW G.E., 600 V. D.C. to 700 H.P. 13200/6600 V.
1—500 KW G.E., 600 V. D.C. to 700 H.P. 2200 V.
1—500 KW G.E., 250 V. D.C. to 1000 KVA. 2300 V. Syn. Motor.
1—400 KW G.E., 250/275 V., D.C. to 600 HP, 2300 V.
1—250 KW Cr. Wh. 230 V. D.C. to 450 KVA. 2300/4000 V. Syn. Motor.
1—150 KW G.E., 250 V. D.C. to 200 KVA, 440 V.
1—125 KW WHSE., 250 V. D.C. to 200 H.P. sq. cg., 440 V.
1—100 KW WHSE., 250 V. D.C. to 159 KVA. 2300 V.
1—100 KW WHSE., 250 V. D.C. to 175 H.P. sl. rg. 2200 V.
1—75 KW G.E., 125 V. D.C. to 120 H.P., sq. cg., 2300/4000 V.
2—50 KW G.E., CD, 125 V. D.C. to 75 H.P., sq. cg., 2300/4000 V.
1—40 KW WHSE., 230 V. D.C. to 45 KVA 2300 V.

TURBO GENERATOR SETS

1—500 KW Whse. 625 Kva. 440 V. 3 ph. 60 cy. 3600 RPM with Parsons 145/175 lb. cond. turbine complete with jet cond. and access.
1—500 KW G.E. 625 Kva. 2300 V. 3 ph. 60 cy. with Curtis 4-stage 150 lb. cond. turbine with cond. and access.
1—75 KW Ridgeway 250 V. D. C. with Terry turbine 180 lb. pressure with 12 lb. bk. pres., 2000 RPM.

A. C. GENERATORS AND SYNO. MOTORS

3 Phase—60 Cycle

HP or KVA	Make	Type	Volts	Speed
1—1000	Whse.		2300	900
1— 625	Whse.		480	900
1— 500	G.E.	TS	440	360
1— 250	G.E.	ATB	2300	600
1— 250	G.F.	ATI	220	450
1— 225	G.E.	ATB	220	600
1— 159	Whse.		2400	900
1— 150	Whse.		4000	1800
1— 100	Whse.		2400	900
2— 100	Whse.		2300	1800

A. C. MOTORS

3 Phase—60 Cycle
SLIP RING

HP	Make	Type	Volts	Speed
2—1200	Cr. Wh.	801Q	2300	237
1— 800	Al. Ch.	ANY	440	885
1— 800	Whse.	CW	440	357
1— 600	G.E.	IM	440	900
1— 450	Whse.	HW	2200	875
1— 400	Al. Ch.	ANY	440	1200
1— 400	G.E.	MT	550/440	300
1— 400	Al. Ch.	ANY	2300	505
1— 350	G.E.	MT-442	2300/4000	257
1— 300	G.E.	IM	440	720
1— 300	Whse.	CW	440	585
1— 250	G.E.	MT	4000/2300	257
2— 200	G.E.	IE-M	2200	1750
2— 200	Whse.	CW	2200	514
1— 200	G.E.	I-M	440	600
2— 175	G.E.	IE-M	2200	880
1— 150	G.E.	IM	2200	695
1— 150	G.E.	MT-564	440	600
1— 150	G.E.	IM-17B	2200	290

A. C. MOTORS

SQUIRREL CAGE

H.P.	Make	Type	Volts	Speed
1—500	G.E.	I-17B	2200	690
1—400	Whse.	CS-1104A	2200	585
1—300	Whse.	CS	550	580
1—300	G.E.	IK	440/2300	600
1—250	Al. Ch.		220/440	1150
1—200	Whse.	CS	2300	1200
1—200	G.E.	IK	2200	490
1—200	Whse.	CS	4600	900
1—150	Al. Ch.	AN	440	1765
1—100	Whse.	CS	550	1750

GEAR REDUCTION UNITS

1—2100 H.P. Whse. 1800/360 RPM.
1— 943 H.P. G.E. 5306/1200 RPM.
1— 750 H.P. Al. Ch. 3600/600 RPM.
1— 450 H.P. G.E. 3600/1200 RPM.

THE BELYEA REPUTATION PROTECTS YOU!

ROTARY CONVERTERS

3 Phase—60 Cycle

1—1500 KW Whse., 720 RPM., D.C. 600 V. A.C. 11500 V.
1—1500 KW Whse., 600 RPM., D.C. 600 V. A.C. 11500.
1—1250 KW G.E., HCC, 720 RPM., D.C. 250 V. A.C. 2300 V.
1—1000 KW Whse., 900 RPM., D.C. 600 V. A.C. 11000/2300 V.
2—750 KW Whse., 1200 RPM., D.C. 600 V. A.C. 5500/2300 V.
1—750 KW Whse., 900 RPM., D.C. 600 V. A.C. 6600/2200 V.
1—500 KW Whse., 900 RPM., D.C. 250 V. A.C. 2300 V.
1—500 KW Whse., 1200 RPM., D.C. 600 V. A.C. 2300 V.
2—375 KW Whse., 1200 RPM., D.C. 250 V. A.C. 2300 V.

Rotary Converters

3 Phase 25 Cycles—Booster Type

2—1500 KW G.E., HCC, 500 RPM., D.C. 225/275 V., 6000 Amp., A.C. 13200/6600 V.
1—500 KW G.E., HCC, 750 RPM., D.C. 225/275 V., 2000 Amp., A.C. 6600 V.

TRANSFORMERS

60 Cycle

KVA	Make	Ph.	Type	Voltages
3—1000	G.E.	1	HKDD	13200x2300
4— 525	G.E.	1	HJ-DD	2300x445
3— 400	Whse.	1	S	2400x440
2— 333	Whse.	1	OISC	2300x460
2— 333	Pitts.	1	OISC	2400x220
3— 300	G.E.	1	H	13200x2300/575
2— 200	G.E.	1	HILD	26400x115/460
3— 200	G.E.	1	H-KDD	13800x220/440
3— 150	Whse.	1	SK	2200x440/220
3— 150	Whse.	1	SKM	2400x120/240
6— 100	Whse.	1	SK	6900x460/230
3— 100	Whse.	1	OISC	13200x250

D. C. MOTORS

HP	Make	Type	Volts	Speed
1—1500	Whse.		550	330
1—1250	G.E.	MCF	250	650
2—1250	G.E.	MPC	500	130
1— 800	G.E.	MPC	550	600
2— 625	G.E.	MPC	250	130
2— 600	G.E.	MPC	550	600/800
1— 600	Whse.		230	150/275
1— 350	G.E.	MPC	230	450
1— 300	G.E.	MCF	230	400/1000
2— 300	G.E.	DMC	230	400/600
1— 300	Cr. Wh.	CMC 102H	230	1150
2— 300	Whse.		500	250/400
1— 300	G.E.	MPC	230	275/550
1— 300	G.E.	MPC	230	250/440
1— 250	Al. Ch.	Irt	230	525
2— 200	Whse.		230	400/500
1— 175	Whse.	SK	250	150/525
6— 150	G.E.	RC-19	230	800/1000
1— 150	Whse.	SK	230	300/900
2— 125	G.E.	CO-1832	230	625
2— 120	Whse.	SK	230	720
1— 100	Al. Ch.		230	950/1150
3— 100	G.E.	LC	230	1200
1— 100	G.E.	MPC	230	225/450
1— 100	Whse.	SK	230	600
2— 100	G.E.	RC-19	230	575/720
1— 75	G.E.	C	230	500/1000
4— 60	Diehl	K-11	230	500/1000
2— 60	Cr. Wh.	CMC-65H	230	500/1000
4— 50	G.E.	RC-16	230	650/815
1— 50	Cr. Wh.	CMC-81H	230	300/900
1— 50	Cr. Wh.	CMC-80H	230	380/750
1— 50	G.E.	RC	230	400/1200

RENUBILT BELYEA MOTORS

SUCCESSFUL OPERATION GUARANTEED

BELYEA

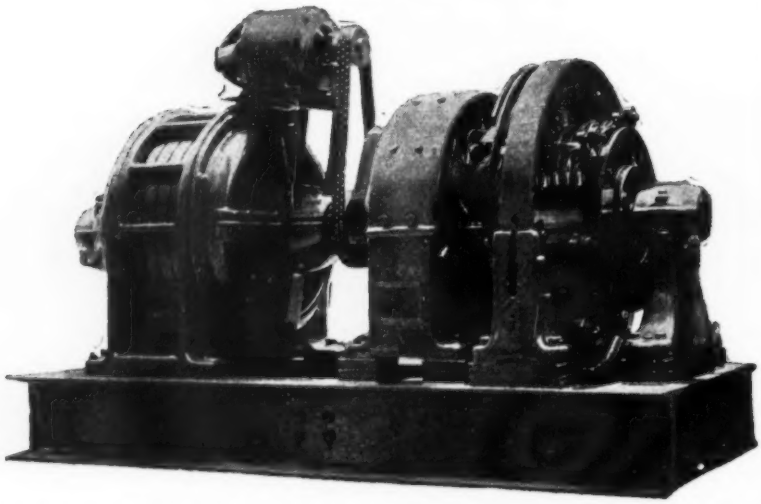
COMPANY INC.

***Main Office & Shop:* 43 HOWELL ST., JERSEY CITY, N. J.**

Delivery from Stock!

GENERATORS

Anodizing, Electroplating, etc.



Actual Photograph 1500 Ampere 10 to 50 Volt D.C. Generator, separate excited, driven by 3 phase, 60 cycle 220/440 Volt A.C. Motor.

2—3200 Ampere General Electric
10 to 60 Volts

3—3200 Ampere Westinghouse
7½ to 30 Volts

3—1600 Ampere General Electric
10 to 60 Volts

5—1600 Ampere Westinghouse
7½ to 30 Volts

6—800 Ampere Westinghouse
7½ to 60 Volts

With A.C. or D.C. Driving Motors
Separate Excited

FULL RANGE VOLTAGE VARIATION

AC GENERATORS

H.P.	Make	Speed
200 KW	G. E.	600
150 KW	G. E.	720
150 KW	G. E.	900
100 KVA	West.	600
75 KVA	West.	900
25 KVA	West.	1800

MISCELLANEOUS

7 x 6 Ingersoll Rand Air Compressor
12½ x 12 American Air Compressor

BELTED AND MOTOR DRIVEN DC GENERATORS

200 KW	West.	600 volts
125 KW	G. E.	125 volts
100 KW	West.	250 volts
75 KW	Al. Ch.	250 volts
60 KW	G. E.	600 volts
50 KW	West.	125 volts
45 KW	West.	250 volts
30 KW	Fl. Dy.	600 volts
40 KW	Cr. Wh.	125 volts
20 KW	G. E.	125 volts
15 KW	West.	125 volts

16 additional Motor Generator Sets, 125 volts–250 volts, 600 volts direct current down to 1 KW

1 Year Guarantee!

Completely Shop Reconditioned and Tested Before Shipment

New York City's Largest Stock Electrical Equipment

L. J. LAND & CO.

146 GRAND ST. *CAnal 6-6976* **NEW YORK, N. Y.**

READING, PA.
10TH AND EXETER STS.

YORK, PENNA.
227 NORTH GEORGE ST.

PARTIAL LIST ONLY!!

230 VOLT DC MOTORS

H.P.	Make	Speed
300	G. E.	1100
150	West.	600
60	Roth	600
60	G. E.	480/1100 (2)
50	West.	550/1100
50	Cr. Wh.	700 (2)
50	G. E.	850
45	Diehl	850/1020
45	G. E.	1800
40	Cr. Wh.	915
35	West.	1150
35	G. E.	440/1800
25	Diehl	850/1020
25	G. E.	1150
25	Rel.	1150
25	G. E.	575
20	Cr. Wh.	1750
20	G. E.	1200
20	R. & M.	1160
20	G. E.	1150 (4)
20	West.	1150
20	G. E.	1150
20	G. E.	800 (2)
15	Star	1450
15	West.	1250
15	G. E.	1250
15	Eck	1100
15	G. E.	1150 (3)
15	G. E.	1150 (3)
15	Cr. Wh.	900/1800
15	West.	850
10	Rel.	1750
10	West.	850 (2)
10	G. E.	825 (3)
10	G. E.	700
10	Diehl	1750
10	Al. Ch.	600/1800
10	West.	600/1200
10	G. E.	400/1600
10	West.	400/1200 (2)
9	Al. Ch.	1750
9	G. E.	450/1800
8½	Diehl	900
8½	West.	850
8½	West.	350/1400
8	G. E.	500/1500
7½	Sturt.	3600
7½	Peer.	1700
7½	West.	1450
7½	West.	1150 (2)
7½	G. E.	1150
7½	West.	975
7½	Al. Ch.	850
7½	El. D.	550/1650
7½	Watson	525/1150
7½	G. E.	450/1800
7½	G. E.	400/1600
7½	West.	400/1600
7½	Al. Ch.	350/1050
7½	G. E.	300/1200
6	G. E.	400/1200
6	G. E.	850
6	G. E.	450/1800 (2)
5½	West.	500/1500 (2)
5	West.	850
5	G. E.	900 (2)
5½	G. E.	400/1600
5	West.	1800
5	G. E.	1700
5	G. E.	1150 (2)
5	West.	1160
5	Al. Ch.	1150
5	Cont.	600/1800
5	West.	850
5	G. E.	850
5	Star	600/1200
5	El. Dy.	550/1650
5	G. E.	450/1800
5	G. E.	600
5	G. E.	450/1350
5	West.	400/1200
5	El. Dy.	235/1100
4	G. E.	850/1150
3½	West.	850/1600
3	G. E. & West.	1700 (5)
3	G. E. & West.	1150 (6)
3	Roth	500/2200
3	G. E.	500/1500
2½	West.	480/1800

325–230 volt DC Motors down to 1/20 H.P.

115 VOLT DC MOTORS

H.P.	Make	Speed
20	West.	200/900
15	West.	1100
15	Cr. Wh.	800
10	Lo. All.	3500
10	G E.	1150 (3)
10	West.	1150
10	West.	850
10	Fl. Dy.	425/1275
7½	G. E.	850 (2)
6	Burke	650
5	Cr. Wh.	1875
5	Col.	1500
5	West.	1100 (2)
5	Cr. Wh.	960

75 additional 110 volt Motors down to 1/6 H.P.

3 PHASE SQUIRREL CAGE MOTORS

H.P.	Make	Speed
200	G. E.	600
150	G. E.	1750
150	West.	1170
147	West. 25 cycle	715
100	Cr. Wh.	1800
100	G. E.	900
100	West.	720
100	G. E.	580
75	West.	870
50	Al. Ch.	690
40	G. E.	900
35	G. E.	1200
35	Wagner	850
30	U. S.	3450
30	West.	1750
30	Al. Ch.	850
30	Al. Ch.	600
25	Wagner	1200
25	West.	1140
25	Diehl	865 (5)
25	G. E.	900
25	Wagner	720
20	G. E.	1750 (3)
20	G. E.	1200 (2)
20	Cr. Wh.	1200 (2)
20	Al. Ch.	900 (2)
20	Diehl	900 (3)
20	G. E.	720
20	West.	1720
15	G. E.	3600
15	Cr. Wh.	1700
15	G. E.	1200 (3)
15	G. E.	900 (3)
15	Wagner	720
15	G. E.	600
10	G. E.	720 (5)
10	G. E.	3450
10	West.	1150
10	G. E.	900
7½	G. E.	3450
5	West.	900

40 additional three phase Motors down to ¼ H.P.

2 PHASE SQUIRREL CAGE MOTORS

H.P.	Make	Speed
75	Cr. Wh.	870
50	Line.	900
50	G. E.	900
40	G. E.	900
40	Al. Ch.	900
35	Al. Ch.	900
30	West.	1200
25	G. E.	1200
20	West.	1150
20	Star	1150 (2)
15	West.	3450
15	G. E.	1200
15	F. & M.	900
10	G. E.	1200
10	G. E.	900
7½	G. E.	900
7½	G. E.	600/1350
5	G. E.	900
5	Al. Ch.	1200

40 additional two phase Motors down to ¼ H.P.

SINGLE PHASE MOTORS

H.P.	Make	Speed
20	Wagner	1160
20	Century	1165
15	Century	1720
7½	Century	3500

8 additional single phase Motors

SLIP RING MOTORS

H.P.	Make	Speed
500	Al. Ch.	1180
250	G. E.	600
200	West.	720
200	G. E.	495
150	Al. Ch.	720
125	West.	1200
125	Burke	600
75	Al. Ch.	575
75	West.	1200
60	West.	1200
60	West.	290
50	Ideal	1740
50	G. E.	900 (3)
40	Wagner	1200
40	F. M.	900 (2)
40	West.	900
40	Line.	720
30	G. E.	720
30	G. E.	1200
25	Al. Ch.	900
25	Wagner	1200
25	G. E.	600
20	G. E.	900
20	West.	600
15	G. E.	900

33 additional slip ring Motors down to 1 H.P.

REBUILT POWER EQUIPMENT

READY TO SHIP!

ROTARY CONVERTERS

1—200 kw. G. E. 275 v. 900 rpm., 6 ph. 60 cy. complete with overspeed device and transformers.

1—500 kw. G. E. type HC-8 600 volt, 900 rpm., 6 ph., 60 cy. pedestal bearing with overspeed device complete with transformers.

MOTOR GENERATOR SETS

500 kw. G.E. 250 v. D.C. 1200 rpm., 2300 c. 3 ph. Syn. Motor.

150 KW Ridgway 250 v. DC, 900 rpm. dir. con. 2300/3/60 syn. motor, complete.

125 kw. Cr. Wh. 250 v. D.C. 1200 rpm., 220/440 v. 3 ph. 60 cy. Ind.

ENGINE GENERATOR SETS

225 kw. Elec. Machy. 2200 or 220 v. 2 ph. 6 cy. dir. con. Ideal Steam.

1—225 kw. Elec. Machy. 2200/220 or 440 v. 3 ph. 60 cy., 200 rpm. dir. con. Ideal Engine 4 valve non-releasing.

100 HP. LIGERWOOD HOIST

Double drum Speedwell 2500 lb. pull at 450' per min. direct driven by 100 hp. A.C. or D.C. Motor.

A.C. GENERATORS

219 kva. G.E. 2300/3/60 200 rpm. 80% P.F. (Can be reconnected 440 or 220 v.)

1—250 KW 480 V., 3/60, Allis-Chalmers, 150 rpm.

2—115 kva. West. 2300/3/60 900 rpm.

D.C. GENERATORS

1—750 KW. 250 v. D.C.,115 rpm., West.

A.C. MOTORS—3 ph. 60 cy.

Qu	HP	Make	Volts	Speed	Type
18	¼	G. E.	220	900	K
33	½	G. E.	220	1140	K
19	1½	Ilg. (Totally enclosed)	220	490	ball bearing
5	5	G. E.	220	900	KT-751
6	10	American (Enclosed — ball bearing)	440	1200	PK
1	10	Allis Chal.	220	1200	
1	10	G. E.	220	1200	K-326
1	10	G. E.	220	900	KT-502
1	10	Allis Chal.	440	575	
1	10	American (Enclosed — ball bearing)	440	570	PK
3	10	G. E.	440	570	KT-322
11	10	G. E.	440	495	KT-332
9	15	Allis Chal.	440	1500	AN
1	15	G. E.	440	1800	I-10
1	15	G. E.	220	1200	KT-954
1	15	Burke	220	1200	EM1.2
1	15	G. E. (High torque — low starting current — across the line start)	440	1200	FTR-502
1	15	Triumph	220	1150	
1	15	G. E.	440	900	I-K
1	15	G. E.	440	900	KT-322
2	15/30	West (Two speed Induction Motor)	220	550/1100	MS
1	15	Allis Chal.	440	860	ball bearing
1	15	G. E.	440	865	
1	15	West.	440	880	CS
2	15	Triumph	440	850	ball bearing
3	15	G. E.	440	690	KT
3	15	G. E.	440	575	KT-326
8	15	G. E.	220	570	KT-332
2	15	West.	220	550	MS
1	15	West.	440	450	CS
1	15/45	West.	440	450/850	CS
9	20	Allis Chal.	440	1800	AN
1	20	West.	220	1750	
1	20	Reliance	440	1200	
10	20	American (Enclosed ball bearing)	440	1200	PK
1	20	G. E.	440	1200	KT
1	20	G. E.	440	875	
1	20	G. E.	220	900	KT-522
1	20	Triumph (High torque)	220	900	TR10-S
1	20	G. E.	220	900	
1	20	Allis Chal.	440	720	
9	20	G. E.	440	690	KT-332
1	20	G. E.	220	680	KT-322
1	20	West.	440	680	
1	25	Crocker Wh.	220	1150	118-Q
2	25	G. E.	220	900	KT-326
1	25	Crocker Wh.	220	900	
1	25	G. E.	220	900	KT-332
2	25	West.	220	720	CS

A.C. MOTORS—3 ph. 60 cy.—cont.

No.	HP	Make	Volts	RPM	Type
1	30	Allis Chal.	440	1800	
1	30	G. E.	440	1200	KT-332
2	30	West.	220	1100	MS
1	30	Triumph	220	900	B-125
1	30	Allis Chal.	220	900	
1	30	Allis Chal.	220	900	NR
1	30	Triumph	220	525	TR-138
1	35	G. E.	440	1200	I
1	35	Lincoln	220	720	
1	35	G. E.	440	600	KT
2	35	West.	220	514	CS
1	30/36	G. E.	220	3600	KT-205y
2	35	G. E.	550	900	I-8
1	35	Crocker Wh.	220	570	122Q
1	40	Allis Chal.	220	900	
1	40	Century (Automatic Start)	440	900	AS-40
1	40	G. E.	220	720	KT-346
1	40	Amer. Elec. (Vertical ball bearing)	440	685	
2	40	Amer. Elec. (Enclosed ball bearing)	440	685	PK
1	40	West.	220	600	CS
1	45	West.	440	850	CS
1	50	U. S. Elec. (Vertical — ball bearing — automatic start)	440	3600	STUS
7	50	Allis Chal.	440	1800	AN
2	50	West.	440	1800	C
1	50	G. E.	440	1800	KT
1	50	G. E.	220	1200	KT-343
1	50	Crocker Wh.	220	1160	
1	50	West.	440	1120	C
1	50	G. E.	440	900	KT-342
1	50	G. E.	440	900	I-8
2	50	West. Elec.	440	870	
3	50	Wagner	440	850	
1	50	West.	440	850	CCL
1	50	West.	440	650	CCL
2	50	West.	220	600	CS-752C
1	50/100	West.	440	345/700	CS
1	54	Allis Chal.	440	900	
6	60	Allis Chal.	440	1800	AN
1	60	G. E.	440	1800	KT
1	60	West.	440	1800	C
1	60	G. E.	220	720	I-8
1	60	Crocker Wh.	220	670	122Q
1	60	Triumph	220	430	
1	65	West.	440	1800	M
6	65	Allis Chal.	440	1800	AN
2	65	G. E.	440	1800	KT-347
2	75	Louis Allis (Adjusto speed clutch motors — normal torque — low starting current, ball bearing, nema frames)	440	450/1725	DV-505y
1	75	G. E. (Ball bearing, drip proof — normal torque low starting current)	440	1180	FT-542
1	75	G. E.	220	900	I-8
1	75	G. E.	440/550	720	I-10
1	75	West.	220	600	CS
1	75	Crocker Wh.	220	514	124Q
3	100	G. E.	440	1800	KT-347
1	100	G. E. (Ball bearing, drip proof — Normal torque — Low starting current)	440	1800	FT-542S
1	100	West.	220	1750	
1	100	G. E.	220	1200	I-8
1	100	Allis Chal.	440	900	
1	100	G. E.	440	720	I-K-14
1	100	Allis Chal.	220	600	
1	100	Crocker Wh.	220	575	124QB
1	100	G. E.	440	400	I-K
1	100	G. E.	440	200	syn
1	125	Wagner	440	1800	
1	125	G. E.	440	1800	I
1	125	Allis Chal.	440	1800	AN
1	125	Crocker Wh.	220	720	124QB
1	125	Allis Chal.	440	695	
2	125	G. E.	550	514	I-K
1	125	G. E.	440	450	I-K
1	125	G. E.	220	440	I-K
1	125	G. E.	550	400	I-K
1	150	Allis Chal.	2200	1800	AR
1	150	Wagner	440	1800	
1	150	G. E.	440	1800	I-4
1	150	Allis Chal.	440	1800	AN
2	150	G. E.	440	900	I-K
2	150	G. E.	440	600	I-K
1	150	G. E.	550	575	I-K
2	150	G. E.	550	514	I-K
1	150	G. E.	440	514	I-K
1	150	G. E.	220	450	I-K
1	150	G. E.	550	450	I-K
1	150	G. E.	2200/400	450/243	
1	150	West.	2200	327	syn
2	150	G. E.	440	200	syn
1	200	G. E.	2200	1800	KT
1	200	G. E.	2200	1200	I-K
1	200	West.	2200	900	CS-967A
2	200	G. E.	550	720	I-K
1	200	West.	220	580	CS
2	200	G. E.	220	600	I-K
2	200	G. E.	550	600	I-K
1	200	G. E.	550	514	I-K
1	200	G. E.	220	514	I-K
4	200	Allis Chal.	2300	347	AN
1	225	G. E.	2200	200	syn
1	250	G. E.	550	720	I-K
4	250	Allis Chal.	2300	435	AN
1	260	West.	2200	450	syn
4	400	West.	2200/220/440	500	CS
1	1000	G. E.	2300	509	K

SLIPRING MOTORS—3 ph. 60 cy.

No.	HP	Make	Type	Volts	RPM
1	1500	Westg.	CW	2200	435
1	700	G. E.	MT-432	2200	393
1	400	Westg.	CW	440/220	1170
1	300	Westg.	CW-1106	2200	580
1	300	W. El.	I-12	440/220	600
1	250	Westg.	CW	2200	345
2	250	G. E.	I	550	600
1	100	G. E.	I	220	450
1	100	Westg.	CI	220/440	1750
1	75	Cr. Wh.		220/440	875
1	60	Triumph	C-16	220/440	430
1	60	Westg.	HF	2200	690
1	53	G. E.	1	220/550	1165

TRANSFORMERS—1 ph. 60 cy.

3—1500Kva. Pittsburgh Transformers, 22,000 volt Primary, 6900/6600/2200 volt secondary.

No.	Kva.	Pri.	Sec.	Make	Ph.
1	250	2300	460	G. E.	
3	150	22000	6900	Pgh.	
1	150	2200	230/460	G. E.	3 ph.
1	100	2200	11C/220	G. E.	
3	100	6600	550/440/220	Pgh.	
2	75	2200	220	Burke	3 ph.
2	50	2300	220/440	G. E.	
3	50	11430/6600	550	Al. Ch.	
3	50	6600	575	G. E.	
1	37½	2300	220/440	Wagner	
3	37	4400	185	West. (Rotary)	
1	30	2200	110/220	G. E.	
2	30	440	220/110	West.	
25	25	2200	122/244	G. E.	
3	15	2200	122/244	G. E.	
35	10	2200	122/244	G. E.	
40	10	2200	122/244	West.	
100	7½	2200	122/244	G. E.	
50	7½	2200	122/244	West.	
50	5	2200	122/244	G. E.	
75	5	2200	122/244	West.	

VARIABLE SPEED MOTORS—230 V. D.C.

No.	Hp.	Make	Type	RPM
1	100	G. E.	re-39	600/720
1	35	West.	sk-140	675/1350
1	30	West.	sk-123	850/1700
1	30	G. E.	rie-	450/900
1	20	West.	sk-120	700/1400
4	20	West.	sk-10L	750/1500
2	10	G. E.	le	625/1250
1	5	G. E.	CD-85	450/1800
2	3	Janta Lieat	BI	650/1950
3	2½	G. E.		500/1000
1	2	West.	SK-63	300/1800
1	2	West.	SK-23	700/2100
1	½	Northern		700/2100

25-30 cy. MOTORS 220/440 V. A.C.

Qu	HP	Make	Type	RPM
1	75	G. E.	I-4	900
1	75	G. E.	KT-357	900
1	75	Allis-Chalmers	AN	900
3	50	G. E.	KT-547	900
3	40	G. E.	KT-347	900
6	40	Allis-Chalmers	AN	900
1	35	Western Elec.	SL13B	500
1	35	West.	M	900
1	30	West.	C	720
1	30	G. E.	KT	900
7	30	Allis-Chalmers	AN	900
2	25	West.	MS	715
9	10	Allis-Chalmers	AN	900
1	10	G. E.	I-4-10	900

SYNCHRONOUS MOTORS

2—150 HP. West. 2300/3/60 900 rpm 80% P.F.

DIESEL ENGINE GENERATOR SET

217 KVA G.E. 2300/3/60 dir. con. 260 HP Buckeye 2 cyl. 200 rpm. semi-diesel engine, complete.

AIR COMPRESSORS

2—677 cfm Nat'l Brake 2 st. 100# with 150 HP. A.C. Syn Motors.

INDUSTRIAL TRUCKS

4 Automatic Lift Trucks 6000# with Ready Power Unit or Batteries.

1—Elwell Parker Tow Tractor 2000lb. with batteries.

1—Baker Tow Truck with batteries.

WRITE, WIRE OR PHONE YOUR ELECTRICAL REQUIREMENTS

DUQUESNE ELECTRIC & MFG. CO.

PITTSBURGH, PA.

DEPENDABLE

Turbo-Generators

A PARTIAL LIST OF OUR INVENTORY

1—G.E. 3125-KVA, 3600-RPM, Condensing: 3/60/2300-v, 200#, 100° SH, 28" vacuum: Surface or Low Level Jet Condenser.

1—Westinghouse 2500-KVA, 3600-RPM, Condensing: 3/60/600-v, 200#, 100° SH, 28" Vacuum: Low Level Jet Condenser.

1—G.E., 1875-KVA, 3600-RPM, Condensing: 3/60/600-v, 200#, 100° SH, 28" Vacuum: Surface or Jet Condenser.

1—G.E., 1563-KVA, Non-condensing 3600-RPM, 3/60/600-v: 150#, 100° SH, 20# back pressure.

1—Allis-Chalmers 1250-KVA, 3600-RPM, 3/60/2300-v, 200#, 500° TT: Surface Condenser.

1—Westinghouse, 1250 KVA 250-v, direct current, condensing, 150/250-Lbs., Surface Condenser.

1—Allis-Chalmers 937-KVA, 3600-RPM, Condensing: 3/60/2300-v, 200#, 500° TT: Surface Condenser.

1—G.E., 625-KVA, 3600-RPM, Condensing: 3/60/2300-v, 200#, 500° TT, 28" vacuum.

1—G.E., 250-KVA, Non-condensing, 3600-RPM: 3/60/480-v, 150#, 0° SH, 28" Vacuum, 10#G, back pressure.

WILMS, WEAVER & CO. Penobscot Building DETROIT, MICH.

We Deal in Turbo-Generators Exclusively

BOILERS

1—813 HP **Edgemoor Boiler**, 200# pressure, Riley underfeed stoker.
2—335 HP **B & W Sectional Header Boilers**, 200# pressure with superheaters, hand fired grates.
2—516 HP **Sterling** 200# pressure boilers, ASME Code, with chain rate stokers.
1—400 HP **Wickes** 3 drum low head boiler, 200# pressure with Chicago Spreader stoker. Installed 1932.
1—90,000# per hr. **Badenhausen** Boiler, 354# pressure.
1—80,000# **Badenhausen Boiler**, 350# pressure with pulverizers and all auxiliaries.
1—1000 HP **Badenhausen Riley** 200# pressure with pulverizer.
1—600 HP **Connelly** 200# pressure.
2—492 HP **Sterling Boilers**, 160# pressure stokers.
1—453 HP **Sterling Boiler** chain rate stoker, 160# pressure.
1—394 HP **Sterling Boiler** chain grate stoker, 160# pressure.
2—250 HP **Sterling Boilers**, 160# pressure equipped with gas burners and controls.
2—253 HP **Sterling Boilers**, 160# pressure with oil burners.
2—250 HP **Wicks Vertical Boilers**, 160# pressure with pulverizers.
2—500 HP **Edge Moor Boilers** 200# pressure.
4—500 HP **Voigt Water Tube Boilers** 175# pressure with chain grate stokers and all auxiliaries.
1—440 HP **B & W Sectional Header Boiler** 150# pressure, underfeed stoker.
1—522 HP **Sterling Boiler** 200# pressure with Firite Stoker.
2—484 HP **Springfield Boilers** 200# pressure.
1—484 HP **Springfield Boiler**, 250# pressure oil burners.
1—520 HP **B&W Sectional Header Boiler**, 200# pressure.
1—**Complete Power Plant** consisting of 2—309 HP **Heine Marine Boilers**, 223# pressure and 2 General Electric Turbines with all auxiliaries.
8—150 HP **Erie City HRT Boilers**, 150# pressure.
1—300 HP **Locomotive Boiler** 150# pressure with all trimmings.
3—250 HP **Erie City** vertical boilers with pulverizers.
1—400 HP **Connelly Boiler** 160# pressure with new tubes and auxiliaries.
2—84" x 20' **HRT Boilers**, 150# pressure all auxiliaries.
2—150 HP **Brownell Boilers**, 125# pressure, rebuilt and guaranteed.
56—50 HP **Vertical Boilers** 150# pressure all auxiliaries.

TURBINES

1—5000 KW **Westinghouse** 1800 RPM 3-60-2300 volts Surface Condenser all auxiliaries.
1—3200 KW **Allis-Chalmers** Condensing **Turbine** with auxiliaries.
1—2500 KW **General Electric Condensing Turbine** with auxiliaries.
1—2500 KW **General Electric Turbine** 400# pressure. Surface condenser.
1—1000 KW **Westinghouse non-condensing turbine** 350# pressure 16# back pres.
1—937 KVA **Allis-Chalmers Turbine.**
1—625 KVA **General Electric Turbine** with jet condenser.
1—2000 KW **Westinghouse Turbine** with Surface Condenser and auxiliaries 3-60-440 volts.
1—300 HP **Kerr Non-condensing** 3600 RPM Turbine.
1—250 KVA **Waite Turbine** either condensing or non-condensing.
1—250 KVA **General Electric non-condensing Turbine.**
1—125 KW **General Electric non-condensing Turbine.**

ENGINE GENERATOR SETS

1—200 KVA **Harrisburg Uniflow Engine Generator Set.**
1—750 KVA **Rice & Sargent** 3-60-600 volt engine generator.
1—480 KW **Rice & Sargent** 3 60-550 volt engine.
1—375 KVA **Chuse Corliss eng. generator.**
1—375 KVA **Chuse vertical Uniflow engine.**
2—312 KVA **Skinner Uniflow engines.**
1—166 KVA **Ames Uniflow engine generator set.**
1—220 KVA **Chuse non-releasing Corliss engine generator.**
1—66" x 125' **steel stack.**
1—48" x 150' **steel stack.**

DIESEL ENGINES

1—300 KVA **Fairbanks-Morse** Full Diesel engine generator set.
1—450 HP **Cooper-Bessemer** Tex rope driven to 300 KW AC Generator.
1—**Complete Diesel Plant** consisting of 1—250 KVA **Buckeye Full Diesel**, 1—225 KVA **Atlas Full Diesel**, 1—94 KVA **Caterpillar Diesel.**
4—500 HP **Busch-Sulzer** 6 cylinder oil engines used only 300 hours.

ENGINE GENERATOR SETS

1—625 KVA **Nordberg** Uniflow engine.
1—1000 KVA **Skinner** Uniflow engine.
1—375 KVA **Skinner** Uniflow engine.

MISCELLANEOUS

2—400 GPM **Centrifugal Boiler Feed Pumps.**
1—2000 HP **Cochrane Metering Feed Water Heater.**
1—10' x 15' **Illinois Forced Draft Chain Grate Stoker.**
1—#8 **Fuller Bonot Pulverizer.**
2—Type AA-6 10 retort **Taylor Underfeed Stokers.**
2—6 Retort **Taylor** Underfeed **Stokers** with fans.

SEE *Fletcher* FIRST!

FLETCHER SALES CO.

325 Fincastle Building LOUISVILLE, KY.

KIEMLE OF TOLEDO, OHIO

MOTORS
GENERATORS
CONTROLS
TRANSFORMERS
MOTOR GENERATOR SETS
ETC.

BERGER OF ROCHESTER, N.Y.

Put all idle equipment to work. Send your list for prompt action.

TRANSFORMERS

1—600 KVA West.—Booster transformer (Auto Transformer Type) 240/208 volts 60 cy. 3 ph.
3—500 KVA, GE, type H, form VD525 19100-22000/40000Y to 2300, 1 phase 25 cycle.
2—75 KVA West. type S.K. 1 ph. 25 cy. 60000 volts Prim—6900/2300 volts secondary.
1—200 KVA Allis Chal. 60 cy. 3 ph., 220/440.
1—300 KVA Gen. Elec. 60 cy. 3 ph., 220/440.

ALTERNATORS

240 KW, 8 PF Electric Machinery, 4600 volts, 60 cycle 3 phase, 450 rpm with direct connected exciter.
200 KVA Gen. Elec. Ft. Wayne 3 ph., 60, 220/440, 720 RPM, revolving field.
150 KVA Gen. Elec. Type ATB form D, 60, 3 ph., 220/440 600 RPM. revolving field, built-in exciter.
75 KVA Westinghouse 3 ph. 60 cy. 480 volts, 900 RPM, with separate belted exciter.

D. C. GENERATORS

150 KW Western Elec. 3 brg. 3 wire, 115/230 V, 600 RPM.
50 KW Milwaukee, Comp. Wound 125 V, 600 RPM.

★400 H. P. SYNCHRONOUS MOTOR★

Complete A.C. Synchronous Motor

1—400 H.P. Wsghse Syn. motor, 3 ph, 60 cy 4000/2300 V, 400 RPM with built-in magnetic clutch. Complete panel mounted reduced voltage type Starting Control. Motor-Generator Set—factory built for excitation and clutch operation. 10 KW, 125 V, DC 1750 RPM, Type SK63, Wsghse, with direct conn. 15 HP, Type CS, 3 ph, 60 cy, 220/440 V.

300 KW Gen. Elect. Synchronous Converter, 6 Phase, type HCC form J, 25 cycle, 750 speed, 220/230 volts. With Transformers for 2300 Volts.

FREQUENCY CHANGERS

All sizes, voltages and cycles.

3 ph. 60 cy. A. C. MOTORS

H.P.	Make		Type		Speed	Volts
300	Gen. Elec.	Sl. Rg.	I Form M.		600	220/440
200	Wsghse.	Sl. Rg.	CW		600	220/440
200	Gen. Elec.	Sq. Cg.	I Form K		514	220/440
175	Ideal	Sl. Rg.	AVA		1750	2200
150	Gen. Elec.	Sq. Cg.	I	K	600	2300
150	Al Ch.	Sq. C.			600	440
150	Burke	Sq. Cg.	3 BRG. 2 ph		900	220/440
150	Elect. Mach.	Syn	—		1200	4150
125	Gen. Elec.	Sq. Cg.	I	K	720	220/440
125	Gen. Elec.	Sq. Cg.	KT547		1800	440

3 ph. 25 cy. MOTORS

H.P.	Make		Type		Speed	Volts
830	Elect. Mach.		Syn.		500	2300
	With Direct Connected Exciter					
150	Gen. Elec.	Sl. Rg.	I Form M		500	2200
100	Wagner	Sl. Rg.	BR		750	220/440
100	Gen. Elec.	Sl. Rg.	I Form M		750	220/440
100	Gen. Elect.	Sq. C.	I	K	750	220/440
100	Wsghse.	Sq. C.	CS		500	220/440
75	Wsghse.	Sq. C.	CCL		500	220/440
75	Gen. Elect.	Sl. Rg.	I	M	750	220/440
75	Wagner	Sq. C.	BM		750	2200
75	Gen. Elec.	Var.	BTA		375/750	440
50	Burke	Syn.	AC133		750	220

230V D. C. MOTORS

H.P.	Make	Type	Speed
125	Gen. Elec	CL	850
105	Gen. Elec.	CL/6 Shunt Wound	700
100	Sprague	C Interpole	600
100	Northwestern	K30 Comp. Inter.	1750
100	Wsghse.	SK143 Shunt Inter.	1750
85	Gen. Elec.	Vert. Comp. Wound	700
75	Crocker Wh.	CCM25JA	1700
50	West.	SK120	1700
40	Fair. Morse	Ball BRG. Vert. Comp.	1740
32	Sturdevant	C Form P. Shunt Wound	190

MOTOR GENERATOR SET

Western Elect. 1000 Amps—40 Volts direct con. to either an AC or DC 580 RPM Motor.

Only partial listing

OVER 10,000 ITEMS IN STOCK FOR IMMEDIATE DELIVERY FROM EITHER ROCHESTER, N. Y. OR TOLEDO, OHIO
REBUILT AND SOLD WITH A STANDARD NEW GUARANTEE.

Write or wire your inquiries

BERGER BROTHERS
ELECTRIC MOTORS, Inc.
395 STATE ST.
ROCHESTER NEW YORK

THE FRED W.
KIEMLE CO.
33 N. SUPERIOR ST.
TOLEDO OHIO

Let MacCABE lift your Worries!

VARIABLE SPEED

H. P.	Make	Type	R. P. M.
1— 2	G. E.	R. F.	500-2000-SH.
1— 3	G. E.	RLC-111	750/1500-SH.
1— 4½	G. E.	RLC-112	900/1800-SH.
1— 5	Reliance	Frame E	500/1800
1— 5	Reliance	Frame F	450/1800
1— 5	West.	SK-33	1150/1650-SH.
1— 7½	Reliance	F-953	450/1850-SH.
1— 7½	Reliance	G-903	275/1650-SH.
1— 7½	West.	SK-103	400/1600-SH.
1— 8	West.	SK-100-L	300/1200-SH.
1—10	Reliance	G-900	400/1200-SH.
1—15	Reliance	230-T	300/1200-SH.
1—70	Reliance	461-T	600/1200-SH.

220/440-V-3-PH.-60-CY. MOTORS CRANE & GENERAL PURPOSE

1— 3	Ideal	A.E.-Crane	1600
1— 3	G. E.	K. Q.-730	1730 (2-Ph.)
1— 3	Wagner	11-V. R. P.	860
1— 5	G. E.	K. Q.-940	1200
1— 6	G. E.	K-254	1735
1— 7½	G. E.	KT-944	1800
1—10	F. M.	OS-FW-324	1740
1—10	F. M.	OLS-326	1200
1—10/2	G. E.	KT-5224	600/1200
1—11	Louis Allis	Crane	1200
1—11	P & H	HW-10A	820
1—15	El. Dyn.	F. R.-1601	1145
1—20	G. E.	I	1200
1—22	P & H	HW-20	840
1—25	F. M.	H	900
2—25	F. M.	H	1200
1—25	West.	C1	690
1—25	West.	C8	900
1—30	West.	C1	690
2—25	G. E.	KT-326	1160
1—30	West.	C1	1150
2—35	West.	C1 885	900
1—35	G. E.	I-Form h.	1800
1—40	G. E.	ITC-5012	600
1—40	G. E.	K-444	1800
1—35	F. M.	H	1200
1—50	G. E.	KT-346	870
1—50	G. E.	KT-527	1800
1—52	G. E.	ITC-5013	600

230-VDC. CRANE & MILL MOTORS

H. P.	Make	Type	R. P. M.
1— 1	P & H	5½ x 3½	850
2— 2	Shaw	BE	930
2— 2¼	West.	K-1	730
1— 2½	G. E.	CO-2502	750
1— 2½	Reliance	T-224	1600
1— 3½	G.E.	CO-2503	975
4— 3	Shaw	BE	930
1— 5½	G.E.	CO-1804	725
1— 6	C. W.	M. L.	930
1— 6	G. E.	CO-1805	1150
1—10	G. E.	CO-2503	850
1—19	C. W.	BW	650
1—20	G. E.	CO-2504	850
2—20/30	G. E.	MD-104	725/575
4—25	G. E.	CO-1809	550
3—30/45	G. E.	MD-104½	625/500
1—65/85	G. E.	CO-1830	700/650
1—85	G. E.	CO-1830	550
1— 150	West.	MCB-100	365

GENERAL PURPOSE 230-VDC. MOTORS

H. P.	Make	Type	R. P. M.
2— 3	West.	CD-925	1725-SH.
1— 3	G. E.	CD-55	1150-SH.
1— 3	Reliance	T-224	3500-SH
3— 5	West.	SK-40	850-SH.
2— 5	West.	SK-30	1100-Comp.
4— 5	West.	SK-30	1100-SH.
2— 7½	West.	SK-60	850-Comp.
1— 7½	West.	SK-40	1150-SH.
1—10	West.	SK-50-L	1300-SH.
1—15	Allis. Chal.	Shunt	800
1—15	C. W.	Size 15-J	800-Comp.
1—15	G. E.	C. D -75	1750-SH.
2—25	West.	SK-100-L	1100-SH.
1—40	Reliance	R. H.-992	1200-Comp.

SPECIAL: 600-HP. G.E. Synchr. Motor, Type TS, 600-RPM. 2200/3/60-Cy., #4315876.

T. B. MacCABE COMPANY

4306 CLARISSA STREET — PHILADELPHIA 40, PA.

CHICAGO'S LARGEST AND MOST COMPLETE STOCK

MOTOR-GENERATOR SETS

KW	Make	DC Volts	AC Volts
750	Wtg.	275	syn. 3/60/440
150	Ideal	250	ind. 3/60/440
100	Wtg.	250	ind. 3/60/220
100	G.E.	250	ind. 3/60/2200
100	Wtg.	125	ind. 3/60/2200
90	Wtg.	110	AC gen. 3/60/2300
60	Al.Ch.	110	ind. 3/60/2200
75	G.E.	125	ind. 3/25/440
75	G.E.	250	ind. 3/60/440
75	G.E.	250	syn. 3/60/2200
75	G.E.	125	ind. 3/25/220
75	G.E.	125	syn. 3/60/220
25	Chandys.	125	ind. 3/60/220
22½	G.E.	125	ind. 3/60/220
20	G.E.	230	ind. 3/60/230
15	Idval	220	ind. 3/60/220
18	Wtg.	60	ind. 3/60/550
12½	G.E.	115/230	3/60/220

ADJUSTABLE SPEED D.C. 230 V.

H.P.	Make	Type	Speed
50	G.E.	C	575/1000
35/100	G.E.	CD-165Y	425/900
40	Chandys.	F-16	860/1150
35/25	G.E.	RLC203L	400/600/1200
35	Cr. Wh.	CM	375/960
35	Jantz-L.	EI	560/860
25	Wtg.	S-9	560/780
25	G.E.	DLC-25	500/1000
15	G.E.	CE	650/350
10	G.E.	LC	1000/1500
10	Reliance	92T	600/1200
15	G.E.	Canadian	700/1400
7½	Wtg. (550)	SK-48	1150/1725
7½	Reliance	46T	875/1200
5	Burke	WAM12 (2)	650/1950
5	Ft. Wayne	BRG	550/850
5.5	Westg.	3-S	975-1500
3.3	Westg.	SK-23	1300/1800
3	G E.	CD-55	1050/1700
4	G.E.	C	800/1400
3½	Cr. Wh.	CCM	920/1175
2/3/4	G.E.	RC-4	1700/1800
2.25	Roth	28	1550/1750
2.2	G.E.	RC4	600/1000

115 V.

60	G.E.	C	500/1000
20	G.E.	LC	500/1000
20	Triumph	32F	250/1000

PUMPS

Can furnish with motor

GPM	Head	Make	Type
800	325	American	KT4MB
150	80	Gould (2)	#3030
50/100	230	Gould	#1616
150	250	Swaby	#1961
400	100	Haydon	
900	70	Union	19TBP
10/40	120/70	Yeomans (2)	HVS
25/50		Economy	15/20#
125	180	Jennings	78#
100		Blackmer gasoline pump	#100

FREQUENCY CHANGERS

1000 KW General Electric 3/60/460 volt AC generator .8 p.f. 300 RPM with 1400 HP G.E. type ATI .9 3/60/460 v. 400 RPM .9 p.f. motor, 3-pedestal bearing unit amort. wdg. both ends with 33 KW exciter. Serial No. 4,900,000.

90 KW GE adj. unit. 60 HP 3/60/220 4-speed motor, with comp. pole changing sw. rated 90 KW 60/120 cy. 68 KW 60/90 cy. 70 KW 60/100 cy. 60 KW 60/80 cy.

25 CYCLE M.G. SETS

75 KW G.E. CL-6 125 v 2-brg. with 110 HP I-K 3/25/220 ind.

75 KW GE DLC-206A intp. 3-brg. with 115 HP I-K 3/25/440 ind.

BOILERS

1—800 hp. B & W 225 lbs.
3—300 hp. B & W 160 lbs.
1—205 hp. Heine water tube 150#
2—492 hp. Sterling 160 lbs. with stoker.
1—312 hp. Sterling 100 lbs with stoker.
1—516 hp. Stirling 200 lbs. with stoker.

BOILER FEED PUMPS

1—16x10x12 Union Vacuum Pump, brass lined cylinders, force feed lubricator.
1—8½x5x10 Union boiler feed pump, brass lined cylinders, force feed lubricator.

ROTARY CONVERTERS

165 KW G.E. type HCC-6-165. comp. wd. intp. 6/60 AC 250 v. DC. 1200 RPM, 440 v. transfs.
50 KW N.W. 3/60/220 1200 RPM AC to 115 v. DC.

SLIPRING CONTROL

500 HP G.E. autom. type MTC209A, 3/60/2200, 9-sec. stage panel DL128712, Diag. 30069, open.
500 HP G.E. autom. type CR2124, sec. panel, 9-sec. 3/60/2200 V. mine hoist service.

VERTICAL A.C. MOTORS

2-60	Wtg. CS	3/60/2200	1750
7½	F.M. H	3/60/220	3600
7½	G.E. KT	3/60/220	1150
5	Wag. (3)	3/60/220	1725
7½	Wag. (2)	3/60/220	1725
5	Kimble	3/60/440	1200
5	Wtg. bb	3/60/220	850

AIR COMPRESSORS

12x10 Chgo. Pn. NSB 360 CFM 100#.
Ingersoll-Rand ERI 93 CFM 100#.
Bury, 1220 CFM 30# class DCB.

FIRE PUMP MOTORS D.C.

75 HP Northwestern 230 V. 1750 RPM.
100 HP Gen. Elec. 230 V. 1640 RPM.

TRANSFORMERS

No.	KVA	Make	Volts
1	125	Kuhl.	1/60 2300/125
1	100	G.E.	3/60 9000Y/230
1	90	Kuhl.	1/60 440/1.5-6
5	75	Wstg.	1/60 3810/244/122
2	75	Wstg.	1/60 3810/244/122
1	75	Darl.	1/60 10/250
1	30	Kuhl.	3/60 220/55-100
1	15	Ft.W.	1/60 1050-2100/2200-238
1	10	Mol.	1/60 1100-2200/220/440
1	7½	G.E.	1/60 1100-2200/244/488
1	7½	G.E.	3/60 2200-4000/230/460
1	7½	G.E.	3/60 6600Y-230
1	7½	Pitts.	1/60 2200/110/220
1	7	Kuhl.	1/60 430-460/1-1.5-2
1	6	Sorg.	3/60 140/220
1	6	Kuhl.	1/60 100-5:1
1	5	G.E.	1/60 1100/2200/220/440
1	5	G.E.	1/60 1100/2200/110/440
1	3	G.E.	1/60 460/55-110
1	3	Mol.	1/60 1150/115-230
1	3	Mol.	1/60 2200/110-220
1	1.5	A.Ch.	1/60 2200/115-230

2200 VOLT COMPENSATORS

3 Phase, 60 Cycle

HP	Make	Type
150	Gen. Elec.	NR 4747
150	Gen. Elec.	CR 1034-K17
125	Westinghouse	A
125	Gen. Elec.	CR 1034-K17
75/100	Westinghouse	E
100	Gen. Elec.	NR 2724
75	Westinghouse	E
75(3)	Gen. Elec.	NR 2723
75	Gen. Elec.	CR 1034-K17
75	Gen. Elec.	NR 2742
60/75	Gen. Elec.	NR 6693-N13
60	Gen. Elec.	CR 1034-K17
30/50	Westinghouse	E
40/50	Westinghouse	E (2 of these)
50	Gen. Elec.	CR 1034-K17
50	Allis Chal.	RD-31
40	Gen. Elec.	NR 5032-N13
30/40	Allis Chal.	RD-31
35/40	F. Morse	CCOR
25	Gen. Elec.	NR 2085
60/100	Wtg. autom.	Magnetic (4)

CHICAGO ELECTRIC CO. 1320 W. CERMAK RD. CANAL 2900 CHICAGO, ILL.

THE PICK OF POWER EQUIPMENT

TURBO UNITS—60 Cy.
1—18750 KVA Westinghouse Cond.
1—15300 KVA Westinghouse Cond.
1— 6250 KVA General Electric Cond.
1— 6000 KVA Westinghouse Cond.
1— 4000 KVA Allis Chalmers Cond.
1— 3125 KVA General Electric Cond.
1— 3125 KVA Westinghouse Cond.
1— 2500 KVA Westinghouse Cond.
1— 1250 KVA General Electric Cond.
1— 937 KVA General Electric Cond.
1— 750 KVA General Electric Cond.
1— 375 KVA General Electric Cond.
1— 1500 KVA Allis Chalmers Non-C.
2— 1250 KVA General Electric Non-C.
1— 938 KVA West. 375# I.P. 100# B.P. N-C.
1— 625 KVA General Electric Non-C.
1— 470 KVA Westinghouse Non-C.
1— 312 KVA Moore Non-Condensing
1— 250 KVA Westinghouse Non-C.
1— 125 KVA Westinghouse Non-C.

STEAM ENGINE UNITS—60 Cy.
1—1067 KVA Nordberg Uniflow
1— 400 KW Ames Uniflow
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 250 KVA Ridgway 4-valve
1— 210 KVA Skinner Uniflow
1— 187 KVA Chuse Uniflow
1— 94 KVA Ridgway 4-valve

DC STEAM ENGINE UNITS
1—500 KW Skinner Uniflow 250 V.
1—350 KW Ridgway 4-valve 250 V.
1—300 KW Skinner Uniflow 250 V.
1—200 KW Ridgway 4-valve 250 V.
1—150 KW Ames Uniflow 125 V.
1—125 KW Ridgway 4-valve 250 V. 3-wire
1—100 KW Ames Uniflow 120 V.
1—100 KW Elliott 4-valve 250 V. 3-wire

OIL & GAS ENGINE UNITS—60 Cy.
1—400 KW West. (gas) 440 V.
1—312 KVA Anderson 2400 V.
1—200 KW Worthington 2300 V.
1—200 KVA Fairbanks Morse VA 2400 V.
1—187 KVA McInt.-Seymour 2300 V.
2—125 KVA Sterling Petrel (gas) 480 V.
1—121 KVA Fairbanks Morse 240 V.
1—49.5 KVA Fairbanks Morse 120 V.
1— 32 KVA Fairbanks Morse 120 V.

WATER TUBE BOILERS
2—1452 HP B. & W. 350-lb., Stokers
1—1150 HP Badenhausen 260 lb.
1— 868 HP Connelly 250-lb., Stoker
4— 750 HP Edge Moor 200-lb.
2— 490 HP Stirling 200 lb.
1— 400 HP Wickes 200-lb.
2— 336 HP B. & W. 200-lb., McClave-Brooks Stokers
2— 295 HP Union Iron Works 180-lb., Stokers
1— 250 HP Heine Marine 165-lb.

SYNCHRONOUS MOTORS—60 Cy.
1—1000 HP Westinghouse 2300 V. 720 RPM
1— 750 HP Westinghouse 2300 V. 720 RPM
1— 200 HP General Electric 2200 V. 1800 RPM
1— 175 HP General Electric 230 V. 225 RPM
1— 175 HP General Electric 220 V. 200 RPM
1— 150 HP General Electric 440 V. 164 RPM
1— 100 HP General Electric 2300 V. 240 RPM

INDUCTION MOTORS—60 Cy.
4—3500 HP G. E. slip ring 2300 V. 120 RPM
1— 600 HP G. E. sq. cage 440 V. 900 RPM
2— 400 HP G. E. slip ring 3800 V. 1800 RPM
2— 300 HP G. E. sq. cage 440 V. 600 RPM
2— 250 HP G. E. sq. cage 4000 V. 1200 RPM
1— 250 HP G. E. slip ring 2200 V. 450 RPM
3— 50-150 HP West. 2200 V. 343-679 RPM

MOTOR GENERATOR SETS—60 Cy.
1—1500 KW General Electric 600 V. DC
1—1000 KW General Electric 600 V. DC
1— 500 KW General Electric 600 V. DC
1— 500 KW General Electric 250 V. DC
1— 75 KW General Electric 125 V. DC

ROTARY CONVERTERS—60 Cy.
1—1500 KW Westinghouse, 250 V.
2—1000 KW Westinghouse, 250 V.
1—1000 KW Westinghouse, 600 V.
1— 750 KW Westinghouse, 600 V.
1— 500 KW General Electric, 250 V.
1— 500 KW General Electric, 600 V.

OIL CIRCUIT BREAKERS
2— 600 A. 73 KV West. G222AS Outdoor
1— 400 A. 73 KV G.E. FKO 36 Outdoor
6— 400 A. 37 KV G. E. FHKO136 Outdoor
4— 400 A. 34.5 KV Conduit D-16-A Outdoor
2—1000 A. 30 KV Kelman CB-76 Outdoor
4— 600 A. 25 KV West. CO-2 Outdoor
2— 600 A. 15 KV Kelman CB-76 Outdoor
4— 600 A. 15 KV G. E. FKO-60-B Outdoor

FREQUENCY CHANGERS
2—3125 KVA West. 25/62½ cy. 750 RPM
1—3000 KVA G.E. 60/25 cy. 300 RPM
1—2500 KVA West. 25/60 cy. 300 RPM
1—1500 KW G.E. 25/60 cy. 300 RPM
1—1250 KVA G. E. 25/62½ cy. 750 RPM
1—1000 KVA G. E. 60/25 cy. 514 RPM
1—1000 KW G. E. 25/60 cy. 300 RPM
1— 750 KVA G. E. 25/60 cy. 300 RPM

SYNCHRONOUS CONDENSERS
1—2000 KVA G. E. 11000/2200 V. 720 RPM
1—2000 KVA C. W. 11000 V. 600 RPM
1— 500 KVA West. 2200 V. 900 RPM

TRANSFORMERS—1 Ph. 60 Cy.
3— 200 KVA G. E. 66000/13200-22800 V.
3— 500 KVA Allis 33000/480 V.
6— 250 KVA Penn 34500-17250/4600-2300 V.
3— 75 KVA G. E. 33000/13200-11000 V.
2—10000 KVA G. E. 26400/4580 V. 3 ph.
1— 6000 KVA G. E. 26400/2300 V. 3 ph.
1— 6000 KVA G. E. 13200/2300 V. 3 ph.
3— 1500 KVA Pitts. 22000/6600 V.
2— 1000 KVA G. E. 23000-11500/575 V.
6— 833 KVA G. E. 22000/2300-4000 Y. V.
3— 667 KVA Packard 23000/440 V.
1— 667 KVA West. 22000-11000/2300 V.
3— 250 KVA G. E. 22000/11000 V.
1— 5000 KVA American 13800/2300 V.
6— 1667 KVA Pitts. 13200/2300 V.
3— 200 KVA G. E. 13200/2300 V.
3— 150 KVA Pitts. 11000/2400 V.
3— 100 KVA West. 11000/250-125 V.
3— 1250 KVA G. E. 6600/550 V.
3— 667 KVA G. E. 2300-4000Y/500-480-460 V.
6— 100 KVA Pitts. 2300-575 V.

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & Co., INC.

50 CHURCH STREET, NEW YORK CITY

POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt Street
New York, N. Y.

A C TURBINE UNITS
6250 KVA G.E. 2300 V. Cond.
3125 KVA G.E. 2300 V. Cond.
1875 KVA Al. Chal. 2300 V.; Cond.
937 KVA G.E. 2300 V.; Cond.
780 KVA Al. Chal. 2300 V.; Cond.
625 KVA Wghse. 2300 V.; Cond.
500 KVA Wghse. 480 V.; Non-Cond.
375 KVA G.E. 2300 V.; Cond.
375 KVA G.E. 2300 V.; Non-Cond.
312 KVA Elliot 480 V.; Cond.
312 KVA C.W.-Moore, Non-Cond. (450#)
175 KVA Al. Chal.-Sturtevant 220 V.;
112 KVA Al Chal. 240 V.—Terry

STEAM ENGINE SETS
500 KVA G.E. 240 V.—Ames Unif.
375 KVA G.E.-E.B. 4 Valve; 480 V.
300 KW G.E.-Skinner Uniflow; 250 V. DC
255 KVA G.E.-Hamilton Corliss; 240 V.
210 KVA G.E.-Skinner Uniflow; 480 V.
200 KW G.E.-Skinner Uniflow; 125 V. DC
200 KW G.E.-E.B. 4 Valve; 125 V. DC
200 KW G.E.—Skinner Unif. 250 V. D.C.
150 KVA G.E.-Skinner; 220 V.
125 KW G. E.-E.B. 4 Valve; 250 V. DC
100 KW G.E.-E.B. 4 Valve; 250 V. DC
100 KW G.E.-E.B. 4 Valve; 125 V. DC

STEAM ENGINES
Twin 22 x 36 Nordberg Uniflow
21 x 22 Skinner Uniflow
18 x 20 Ames Uniflow

SPECIAL — 937 KVA GENERAL ELECTRIC 3-60-2300 V. CONDENSING TURBO GENERATOR SET; EXCITER; SURFACE CONDENSOR; SWITCHBOARD.
500 KVA Wghse. 3-60-480 V. Non-Cond. Turbine Unit, Exciter, Switchboard.
210 KVA G.E. 3-60-480 V. Alternator-19x20 Skinner Uniflow Engine; Exciter, Switchboard.

COAL PULVERIZERS
8000 lb. Fuller-Bonnet
4500 lb. (2) Erie City Unitype

DIESEL ENGINE SETS
375 KVA Wghse. 3 ph., Busch-Sulzer
312 KVA Burke 3 ph.—Anderson
200 KVA G.E. 3 ph.—Busch-Sulzer
170 KVA F.M. 3 ph.
60 KVA (2) G.E. 3 ph.—Tipps
40 KVA F.M. 3 ph.
50 HP F.M. "VA" belted

TRANSFORMERS
687 KVA (2) Maloney 13,800-460 V.
500 KVA (3) Al. Chal. 33,000-440 V.
250 KVA (3) Packard 22,000-2300 V.
200 KVA (3) G.E. 2400/4160-600 V.
150 KVA (2) Maloney 2300-230/460 V.
100 KVA (3) Al. Chal. 22,000-440 V.
30 KVA (4) Packard 6600-110/220 V.

HEATERS
240,000 lbs. Griscom-Russell
170,000 lbs. Hoppes

BOILERS
749 HP (4) Edgemoor 200 lb.
728 HP E.C. ver. 200 lbs.
600 HP Heine 200 lbs.
600 HP Connelly 200 lbs.
600 HP (3) Sterling 200 lbs.
562 HP Edgemoor 200 lbs.
500 HP (4) Vogt 225 lbs.
471 HP E.C. ver. 160 lbs.
294 HP (2) Un. Ir. Wks. 180 lbs.
250 HP (2) E. C. 200 lbs.
344 HP (2) B & W 160 lbs.
205 HP Heine 165 lbs.

SURFACE CONDENSOR
625 Sq. Ft. Wheeler

AIR COMPRESSORS
3250 GPM 425' head
2200 GPM 400' head
2200 CFM Nordberg 100#—Motor & Steam Driven
1390 GPM 233' head

PUMPS (motor driven)
3600 GPM 85' head
3000 GPM 100' head
850 GPM 243' head
750 GPM Hill 231' head
650 GPM DeLaval 810' head
600 GPM Al. Chal. 450' head

STOKERS
Combustion Engineering for 250 HP
Illinois Chain Grate (2) for 350 HP
Westinghouse for 700 HP
Illinois Chain Grate for 1300 HP

MOTORS • GENERATORS • TRANSFORMERS

Prices on Application

3 PHASE, 60 CYCLE, 220/440 V.

HP	Make	RPM	Type	Frame
5	West.	1200	CCL	2 phase
5	American	600	totally enc.	ball bearing
7½	Gen. Elect.	1800	KT	944
7½	Gen. Elect.	1800	KQ	944 2 phase
10	Fairbanks Morse	900	KBY	
10	Crocker Wheeler	900	ma	365
10	Burke	1800		
15	Reliance	1200		2 phase
15	Howell	900		2 phase
20	Gen. Elect.	1800	KQ501	2 phase
20	Gen. Elect.	565		Form K
25	Gen. Elect.	1740	KQ312	2 phase
25	Armor •	1200	ball bearing	2 phase
25	Gen. Elect.	1800	KT	312
30	Gen. Elect.	3600	KT	513
30	Armor	695	ball bearing	2 phase
50	West.	1200	MS	
50	Fairbanks Morse	1800	ball bearing	
50	Fairbanks Morse	1800	ball bearing	
50	West.	1800	CS	
60	Gen. Elect.	1800	I	form K
75	Gen. Elect.	1800	I	form K
75	Gen. Elect.	900	KT	552
100	Gen. Elect.	1800	I	form K
100	West.	1800	CS	
150	Gen. Elect.	1200	I	form K
150	Gen. Elect.	1200	I	form K

MOTOR GENERATOR SETS

1—125 KW Ridgeway 250 V. DC. 1200 RPM Motor 3/440/60/1200 Complete.

1—100 KW Westinghouse Synchronous-Generator 250-275 V. DC.—Motor 3/60/2300/900 RPM complete with panels.

1—32 KW Westinghouse M. G. Set. Generator Type SK, 250 V. DC. 1750 RPM—Motor 49 HP. Type CS. 3/220/440/60/1750 RPM complete with panels.

ENGINE TYPE MOTOR
625 Hp. Gen. Elect. Synchronous 3 Ph. 60 Cy., 2300 Volt, 180 Rpm.

Mine Slope Hoist

1—Connellsville Mfg. and Mine Supply Hoist —Storage capacity for 11,000 feet 1" Rope— Speed 900' per minute.
Motor—500 HP Gen. Elect. Mt. Slipring 3/60/2200/450 RPM. Complete with remote control, Herringbone reduction gears and demountable base and drum.
Write Wire Phone
Inspection can be made for 30 days in operation. This machine almost new.

TRANSFORMERS

Amt.	Kva.	Make	Cycle	Voltage
3	25	Gen. Elect.	25	2300/115/230/460
3	40	Gen. Elect.	25	2300/230/460
3	50	Gen. Elect.	60	2300/230/460
3	250	Gen. Elec . (new)	60	13,200/2300
3	200	Kuhlman	60	4160/4600/230/460
3	500	Pittsburgh	25	11,500/220
3	1000	Pittsburgh	60	2300/4600/230/460

3 PHASE, 25 CYCLE, 220/440 VOLTS

HP	Make	RPM	Type	Frame
5	Al. Chal.	720	AR	
5	Wagner	1450	Ball B.	Enclosed
7½	West.	750	CS	
7½	G. E.	1500	KT	181
10	G. E.	750	KT	312
10	West.	750	CS	
10	West.	1500	CS	
10	G. E.	1500	I	Form K
15	G. E.	750	KT	
15	West.	1500	CS	
20	West.	750	CS	
25	West.	750	CS	
50	G. E.	750	I	Form K
50	West.	750	CS	
75	G. E.	750	KT	357
75	G. E.	750	I	Form K
100	G. E.	300	I 17	Form K
150	G. E.	750	I	Form K
150	G. E.	750	I	Form K
200	West.	460	CS	2200 Volt
200	G. E.	750	I	Form K
225	Elec. Ma.	500	2200 V.	Synchron
1150	G. E.	375	2300 V.	Synchron
200	West.	235	CW	Slipring

Prices on Application

SLIPRING MOTORS
60 CYCLE, 3 PHASE, 220/440 VOLTS

HP	Make	Speed	Type	Frame
10	Gen. Elect.	1800	MT	303
15	Gen. Elect.	1800	I	form M
20	Gen. Elect.	545	MT	332
20	Westinghouse	575	CW	648A
20	Westinghouse	575	CW	ball bearing
25	Westinghouse	690	CW	
30	Gen. Elect.	1800	MT	327
30	Gen. Elect.	1800	I	form M
40	Westinghouse	690	CW	748
40	Westinghouse	690	CW	748A
40	Westinghouse	690	CW	748A
40	Westinghouse	690	CW	748A
50	Westinghouse	900	CW	
60	Westinghouse	720	CW	2200 volt
75	Westinghouse	1800	CW	
500	Westinghouse	600	CW	

25 Cycle Steel Mill Motors

Amt.	HP	Make	RPM	Type	Voltage
1—	225	Elect. Mach.	500	Synchronous	2300
2—	750	Gen. Elect.	125	Slip Ring	2300
1—	1000	Allis Chalmers	293	Slip Ring	6600
1—	1150	Gen. Elect.	375	Synchronous	2300
1—	1250	Allis Chalmers	294	Slip Ring	6600
4—	1600	Gen. Elect.	93	Slip Ring	2300
1—	2000	Allis Chalmers	294	Slip Ring	6600
1—	2500	Allis Chalmers	295	Slip Ring	6600
1—	2500	Allis Chalmers	146	Slip Ring	6600
1—	3000	Allis Chalmers	184	Slip Ring	6600
1—	5500	Allis Chalmers	370	Slip Ring	6600

FREQUENCY CHANGERS

2—1250 KVA Gen. Elec. Synchronous—motor 3/25/ 2200 750 RPM. direct connected to Generator 3/62½/440 V. Complete with exciters and panels.

1—200 KW General Electric 3 ph., 60 cy., 2300 V. direct connected to 290 HP. Gen. Elec. Synchronous Motor, 3 ph., 25 cy., 440 volt, 750 RPM. Complete with panels.

25 CYCLE CRANE MOTORS
10—25 Hp. Gen. Elect. New MTC 5523. 3/25/440/750 Rpm.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y. CL. 4758

MOTORS

230 V. DIRECT CURRENT

Q	H.P.	Make	Type	R.P.M.
1	450	Al. Ch.	INT.	425
1	150	WSGHSE	SK	1750
1	125	GEN. ELEC.	DLC	550
2	100	Al. Ch.	INT.	1000
1	100	WSGHSE	SA	250
1	75	WSGHSE	SK	1750

3 PH. 60 CYCLE AC. 220/440 VOLT SQUIRREL CAGE

1	125	Cr. Wh.	125Q	900
1	50	GEN. ELEC.	KT327	1800
1	50	WAGNER	22VRM	600
1	40	Reliance		900

SLIP RING

2	150	Al. Ch.		600
1	150	WSGHSE	H. F.	495

SYNCHRONOUS

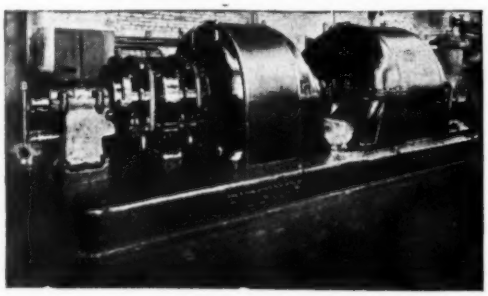
1	450	WSGHSE	550	600
1	268	GEN. ELEC.	2300	600
1	125	WSGHSE	2400	900

Hundreds of other motors from 1 HP up.

GENERATORS 230 V. DC

40 KW CR Whlr. CCD 1085 RPM.
45 KW Diehl K 18 550 RPM.
100 KW Ft. Wayne MPL 550 RPM.
100 KW GE MPL 600 RPM.
200 KW Sprague 525 RPM.
200 KW West. 530 RPM.
250 KW West. 500 RPM.

TURBO GENERATOR SETS



1—750 KW Ridgway, 1800 RPM turbine, mixed pressure 135# Gauge 15# Absolute with C. H. Wheeler 2 Pas surface condenser, direct coupled to a 250 Volt DC Generator 750 KW 1800 RPM.

1—GE 1000 KW Turbine 125# pressure, condensing with jet condenser, direct connected to 1000 KW generator, 3 PH. 60 Cyc. 2300 Volt 3600 RPM.

PUMPS

2—Davidson 14 x 9¼ x 16 Simplex, Double acting Piston pattern, brass fitted.

1—Warren 14 x 8½ x 12 Duplex brass fitted.

1—Blake 14 x 8½ x 10 Simplex.

2—Worthington 6 x 8 Hydraulic.

CONDENSER

1—C. H. Wheeler 3650 Sq. Ft. Surface Cond. 2 pass, complete with pumps.

BOILERS

3—800 HP B & W Straight Tube Waste Heat Boilers, 200 lbs. pressure, complete with Economizers, motor driven induced draft fans, and steel stacks.

2—684 HP Edgemoor Waste Heat Boilers, 200 lbs. pressure complete with Economizers, Super Heaters, motor driven blowers and steel stacks.

2—400 HP B & W Straight Tube Water Tube Boilers, 200 lbs. pressure complete with Combustion Engineering Type E stokers and induced draft fans.

2—253 HP Heine Water Tube Boilers, 160 lbs. pressure, ASME code.

• TUBES

CONDENSER TUBES

Condenser Tubes 1" OD 20 Gauge Admiralty 18 ft., long like new

BOILER TUBES

212 New Seamless 3⅓" 10 ga. boiler tubes 17'1" long.

Thousands Feet of Conduit ¾" to 3"

Write for Bulletin #P-100

HEAT and POWER Company, Inc.

45 BOND STREET Phone: ALgonquin 4-3874 NEW YORK 12, N. Y.

1—400 HP Westinghouse, type GW, 3 ph, 60cy, 440V, 450 RPM slip ring motor

1—300 HP Westinghouse, 3 ph, 60cy, 440V CW slip ring motor 495 RPM

3—250 HP General Electric, 3 ph, 60cy, 440V 1-17A 400 RPM

1—200 HP Allis Chalmers, 3-60-440V, 514 RPM

2—150 HP Allis-Chalmers, 3 ph, 60cy, 440V, 450 RPM slip ring

1—150 HP General Electric type KT, fr. 558 3-60-2200V 880 RPM

1—150 HP General Electric, type ATI, 3 ph, 60cy, 440V 900 RPM, 0.8 PF syn. motor

1—150 HP Electric Mach. syn. motor 125 KVA, 3-60-220V, 1200 RPM

1—150 HP General Electric, 3-60-440V
1—17A 360 RPM slip ring

1—150 HP Westinghouse, 2 ph, 60cy, 440V frame 1000, CW, 390 RPM slip ring

2—125 HP Westinghouse CS774C 3-60-440V 860 RPM Ball bearing

4—100 HP General Electric, 3-60-440V 495 RPM, MT 562 slip ring

1—100 HP General Electric type I, form K, 3-60-220V 575 RPM

1—100 HP Westinghouse, type CCL, 3 ph, 60 cy, 2200V, 1750 RPM, Squirrel Cage

1—100 HP Allis-Chalmers, type ANY, 3 ph, 60 cy, 220V, 690 RPM slip ring

2—75 H.P., 300-foot head Pumps: 2200V Fairbanks-Morse, 1800 RPM 3ph 60cy slip ring motors direct connected to 500 GPM 3 stage

1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V, 450 RPM slip ring

1—75 HP Westinghouse, type CW, 3 ph, 60 cy, 440V, 720 RPM slip ring, 3 or 2 bearings

1—75 HP General Electric, type MT, frame 558, 3 ph, 60 cy, 440V, 575 RPM

1—75 HP Fairbanks-Morse, type H, frame 165C, 3 ph, 60 cy, 550V, 900 RPM Squirrel Cage

1—75 HP Lincoln, type IQ, 2 ph, 60 cy, 440V, 600 RPM Squirrel Cage

1—75 HP Reliance, 3 ph, 60 cy, 440V, 720 RPM totally enclosed fan cooled

1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V, 600 RPM slip ring

1—75 HP General Electric, 3 ph, 60 cy, 440V, 600 RPM, MT558 slip ring

1—75 HP Western Elec. type I, 3-60-440V, 690 RPM

1—75 HP General Electric, 3-60-440V, type I, 575 RPM

3—25/65 HP Westinghouse, frame 762C, 3-60-440V, 600/1200 RPM, 2 speed slip ring motor

1—60 HP General Electric type KT, frame 346, 3 ph, 60 cy, 440V, 870 RPM

1—60 HP Lincoln 3-60-220V frame IXM, Sq. Cage 900 RPM

1—60 HP, General Electric, 3-60-440V, 720 RPM, type I form K

1—60 HP General Electric 3-60-440V, 1750 RPM, type I slip ring

1—60 HP General Electric 3-60-440V, KT542, 870 RPM Sq. Cage

1—50 HP General Electric 3-60-440V, 3450 RPM, KT527 tot. encl. fan cooled

1—50 HP Wagner (Fynn Weichsel) 3-60-440V, 1200 RPM

1—50 HP General Electric 3-60-220V, 1150 RPM, type I, slip ring

1—50 HP Triumph 3-60-440V, type C12, 1150 RPM, slip ring, rotor & stator rewound

1—50 HP General Electric, 3-60-440V, KT 346, 870 RPM, Sq. cage

1—50 HP General Electric 3-60-440V, 900 RPM, type I-M, slip ring

1—50 HP Howell 3-60-440V 870 RPM, type SCBB ball bearing Sq. cage

1—50 HP General Electric 3-60-440V, 720 RPM, type I-K, Sq. Cage

2—50 HP Allis-Chalmers 3-60-440V, 690 RPM slip ring

1—50 HP General Electric 3-60-440V, 690 RPM, MTS 46, slip ring

1—50 HP Ideal 3-60-440V, 580 RPM, type AV, slip ring

3—50 HP General Electric 3-60-440V, 575 RPM, type I-K, fr. 13A, Sq. Cage

1—50 HP Wagner 3-60-440V, 495 RPM, type BM, Sq. Cage

1—50 HP Allis-Chalmers 3-60-440V, 490 RPM, Sq. Cage

1—50 HP General Electric 3-60-440V, 490 RPM, type I-M, slip ring

1—50 HP Westinghouse CS 2-60-440V, 420 RPM, Sq. Cage

We have a stock of 3000 motors from 1 HP to 50 HP in AC and DC. We have a very large stock of air circuit breakers up to 12000 amp.

1—100 HP General Electric, type CD, fr. 123, 230V, 1200 RPM

1—100 HP General Electric, type RF 17, 230V, 400/1200 RPM

1—100 HP Westinghouse type SK, frame 140, 230V, 1700 RPM

1—75 HP General Electric, type CD, fr. 176, 550V, 250/1000 RPM (planer)

1—60 HP Westinghouse, type SK, frame 160, 230V, 680 RPM

1—60 HP Westinghouse type SK140L, 115V, 1150 RPM vertical

1—50 HP Westinghouse, type SK, fr. 160, 230V, 565 RPM

1—50 General Electric, class 5, Form B, 600V, 609 RPM

1—50 HP Westinghouse SK200, 245 RPM 230V

1—DC Generator 45KW Bullock 120V 375A 900 RPM

2—40 HP C & C 230V, 250/1000 (planer)

25 CYCLE MOTORS

1—50 HP Westinghouse 3-25cy-440V, 720 RPM, type MS, Sq. Cage

1—50 HP General Electric, 3-25cy-440V, 700 RPM, type I-M, slip ring

1—40 HP Westinghouse 3-25cy-440V, 1450 RPM, type CS, Sq. Cage

1—40 HP Westinghouse 3-25cy.-440V, 730 RPM, type CI. frame 753A slip ring crane

1—35 HP Allis-Chalmers 3-25cy-440V, 720 RPM, slip ring

1—30 HP General Electric 3-25cy-440V, 1450 RPM, FT 527, vertical B.B.

1—30 HP Westinghouse 3-25cy-440V, 720 RPM, CS, Sq. Cage

The Wente Electric Co.,

Hamilton, Ohio

REBUILT MOTORS & GENERATORS SINCE 1906

SYNCHRONOUS CONVERTERS

500 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM
500 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
500 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
200 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM

MOTOR GENERATORS

200 KW G.E. SYN. 250 V. 2300/4000 A.C. 1200 RPM
200 KW G.E. IND. 600 V. 2300 A.C. 1200 RPM
200 KW R.W. SYN. 250 V. 2300/4000 A.C. 900 RPM

Each unit listed above is owned by us and is available now for immediate purchase.

WALLACE E. KIRK CO.

Incorporated

502 Grant Building Pittsburgh, Pa.

WE SELL — PURCHASE — RENT

Power & Dist. Transf. from one to 5000 KVA. Any Volt or Frequency.

Motors, Generators, Turbines, Centrifugal Pumps, etc.

A.C. & D.C. Elec'l Meters. Potential & Current Transf. All Makes. Scales Calibrated to your requirements.

Catalog & Prices on Request

PHILADELPHIA TRANSFORMER COMPANY

2829 Cedar St. Phila., Pa.

GOOD VALUES—ALWAYS

400 KW 250 V D.C. Uniflow, Non-Condensing.
300 KVA 2300 V Fairbanks Diesel Generator.
420 HP Busch Sulzer 2300 V. Diesel Set.
180 and 270 HP Worthington Diesel Generators.
240 HP 200 KVA 220 V A.C. Diesel Generator.
1574 cu. ft. 100-150 lb. Syn. M.D. Compressor.
75, 125, 200 KVA 257 rpm A.C. Generators.
360 HP Clutch Pulley off Fairbanks Diesel.
200 KW Rebuilt Turbo Generator, 440 Volt.
870 HP 3 unit Diesel Generator Plant, 2300 V.

MISSISSIPPI VALLEY EQUIPMENT CO.

507 Locust St. (1) St. Louis, Mo.

Have you anything for Sale?

1—Westinghouse CS, 500 HP, 450 rpm, AC motor. Needs rewinding. Will rewind to any speed and voltage within capacity of frame.
1—G. E. slip ring motor, I-15A, 125 HP, 900 rpm, 440-3-60, rebuilt.
3—G. E. Transformers, 37½ KVA, 22000/115-230 volt, 1 ph, 60 cy.
1—400 amp. DC welding M-G set, 440-3-60 supply voltage.

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JACKSON BAYLEY ELECTRIC COMPANY
CANTON, OHIO

POWER EQUIPMENT FOR PROMPT SHIPMENT

SQUIRREL CAGE MOTORS (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
700	G.E.	6600	1800	
150	West.	220/440	580	CCL
125/40	Cr. Wh..	2200	700	125AQ
125	Burke	220/440	1200	
125	Cr. Wh.	2200	700	125AQ

DC SERIES & CPD. MOTORS

HP	Make	Type	Speed
2	R & M	122	1000
5	R & M	125	1000
15	West.		650
25	Shaw		600
50	Shaw		600
100	G.E.	MD 108	480
130	G.E.	CO 1812	550
175	G.E.	MDS 190¼	475
200	Allis	Interpole	600

SYN. MOTORS, 3 ph. 60 cy.

HP	Make	Volts	Speed
75 (2)	G.E. ATI	2200	900

SLIP RING MOTORS, (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
1000	Al. Ch.	440	235	
700	G.E.	2200	393	MT 342
300	G.E.	440	600	I-M
200	G.E.	2200	240	MT 412
150	G.E.	220/440	720	I-M
150	Al. Ch.	2200	685	
150	G.E.	220	575	I-M
125	Al. Ch.	2200	435	
100	Al. Ch.	220/440	575	
100	G.E.-25 cy.	220/440	500	MI-108

"Wound Rotor Motors" (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
200	G.E.	2200	600	I-L
150	G.E.	2200	600	I-L

TRANSFORMERS

Qu.	KVA	Make	Voltage
3	37	West.	4400/185
3	50	G.E.	22000/2200
3	75	G.E.	2300/110/220
4	100	Uptegraff	440/220
1	150	G.E. (3 ph.)	2080/230/460

OIL ENGINE DRIVE AIR COMPRESSORS

Chicago Pneumatic simplate valve type, NS03 straight line 16½ & 11 x 18" capacity 492 cu. ft. displacement, 100# pressure, with air receiver and starting air compressor.
2—14x10" Sullivan 505 cu. ft. compressors.
1—10x12 Ch. Pneu. 164 cu. ft. steam compressor.

M-G SETS 3 ph. 60 cy. (Syn)

150 KW West. 550 v. DC—2200 AC 900 RPM
150 KW Ridg. 250 v. DC—2300/3/60 AC
65 KW G.E. 250 v. 1200 RPM—100 HP 220/440 v. AC

ELECTRIC LOCOMOTIVES

4—6 Ton G. E. Storage Battery Loco. 44" Ga. with Batteries (Can change to 36" Ga.)
2—5 Ton West. 250 v. 36" Ga. with Gathering reels.

SCREENS

2—4' x 5' Tyler Hummer Screens with Vibrators.

In addition to the above, we have hundreds of other items in stock—kindly send us your inquiries.

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Pittsburgh, Pennsylvania

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(TRY US! ! !)

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POWER PLANT, with 2, 300 H.P. Boilers complete with 2,500 KW 3/60/2300 Turbines
2—300 H.P. Water Tube Boilers
1—453 H.P. 160# Stirling W. T. Boiler
1— 47 H.P. Vert., 60" dia., A.S.M.E. 150#

COMPRESSORS

248 CFM Chi Pneu with 50 H.P. A.C. Motor
526 CFM Ingersoll-Rand, belt drive
780 CFM Chi Pneu with 125 H.P. A.C. Motor
990 CFM Sullivan with 160 H.P. A.C. Motor

MOTORS

3 H.P. to 75 H.P.—A.C. & D.C. Units
(Write for our complete electrical list!)

GENERATORS

300 H.P. Buckeye Diesel Engine & Gen., 3/60/240
500 KW G.E. Skinner Uniflow Steam Eng. Gen-250 D.C.
100 KW G.E. Type ATB-2-1250-3600, 3/60/2200-900
5000 KW Turbo Generator, 3/60/2300-3600 RPM
POWER PLANT—Complete with 2, 625 KW Turbo Gen.

1000 KW Frequency CHANGER SET 25 to 60 cycles

60 cycle unit 4150 V. 25 cycle unit 9000 V. Complete with starting equipment.

HOISTS

Superior Iron Works, sgl. drum, 36" dia. with 80 H.P. G.E. Type MTC motor
1 to 4 ton cap. sgl. motor monorail type hoists

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"Anything containing IRON or STEEL"

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2-STAGE TURBO G.E. CENTRIFUGAL COMPRESSORS dir. dr. to 300 H.P. G.E. Syn. Motor 3/60/2300-4000/1800. With Panel b. and elec. eqt. Cap. 16 lbs. pr. 2300 CFM.
INGERSOLL-RAND CENT. TURBO COMPRESSORS dir. dr. to G.E. Motors 42 H.P. 3/60/220/3450 with cont. eqt. Cap. 900 CFM at 5.25 lbs. pr. Valves, fitt. included.
SPENCER TURBINE BLOWER with G.E. 50 H.P. 3/60/440/3500 Motor, cap. 2300 CFM at 3 lbs. pr.
ROOTS BLOWER No. 6, 20" blast gate, p dr., 42 CFR. Also ROOTS 14" dis. 13 CFR.
G.E. 50 KW STEAM GENERATOR SET vert. mar. ENGINE dir. dr. on c.i. base. 250 v. D.C.
STURTEVANT 35 KW STEAM DRIVEN GENERATOR SET b. dr. vert. mar. type 250 v. D.C.
GREENFIELD 25 KW STEAM DRIVEN GENERATOR SET b. dr. vert. mar. type 115 v. D.C.
LAIDLAW HORIZONTAL DUPLEX 14"x12" COMPRESSOR, cap. 850 CFM, with 3½' x 12' Tank and fittings. With 150 H.P. 3 ph. Motor, for belt dr.
AMERICAN COMPRESSOR hor. belt-dr. size 11"x12", cap. 400 CFM.
INGERSOLL-RAND COMPRESSOR hor. belt-dr. size 10" x 10", cap. 250 CFM.
NORWALK 4-STAGE COMPRESSOR on iron base with 3 ph. Motor sil. ch. drive, size 7¼"—3⅜"—1⅝"—¾" x 8". For 2000-8000 lbs. press.
CHICAGO PNEUMATIC PORTABLE GASOLINE DRIVEN COMPRESSOR, cap. 220 CFM.
2-STAGE COMPRESSOR GAS-ENGINE driven Unit on base, di. dr. to PALMER 4-cyl. marine type Engine.
INGERSOLL-RAND COMPRESSOR STEAM DRIVEN size 10" x 14" x 10", cap. 503 CFM at 285 RPM.
WESTINGHOUSE AIR BRAKE COMPRESSOR Steam driven, size 11" x 15" x 12", cap. 150 CFM.
STEAM PUMPS Duplex and Simplex, cap. from 1 to 1500 G.P.M. Also Steam Turbines.
GOULDS TRIPLEX PUMP vertical, size 7" x 10". DEANE size 7" x 8" and smaller sizes.
KINNEY 6" NEW ROTARY PUMPS gear dr. on c.i. base. Also BLACKMER 6" ROTARY PUMPS.
INGERSOLL-RAND CENTRIFUGAL PUMP, 16" in. 14" disch., cap. 9700 GPM, 110' hd. at 1150 RPM, on c.i. base.
KINGSFORD CENTRIFUGAL PUMP, 10" in. 8" disch., 2400 GPM 60' hd., on c.i. base di. dr. to 40 H.P. Motor 3/60/220/1150.
TABER CENTRIFUGAL PUMP, 8", di. dr. to WAUKESHA 4-cyl. OIL ENGINE, portable.
BUFFALO #9 Conoidal BLOWER, 58" inlet, belt drive.
STERLING DOUBLE BLOWERS paddle wheel ball-bear. 23" inlets, 66" high. belt dr.

IN ADDITION TO THE ABOVE WE CARRY A LARGE STOCK OF SIMILAR EQUIPMENT IN ALL STANDARD MAKES AND IN SMALLER SIZES.

HIGHEST PRICES PAID FOR YOUR SURPLUS EQUIPMENT.

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140 GRAND ST., N. Y. C. **TEL. CAnal 6-6983-4**

Boilers for Sale

2—414 HP. 250# Stokers, Com. plant
2—250 HP. 160#, Oil fired, com. plant
1—400 HP. 210#, Cox Stoker, complete
1—300 HP. 160#, Vertical Dutch Oven.
Locomotive 80—125 HP. 200#—250#

Turbo Generator units, cond.

2000 KW. 200# pr. 2300 v. 3600 RPM.
3000 KW. 200#, 600 v. 1800 RPM.
2—5000 KW. 200#, 2300 v. 3600 RPM.
***Also* Diesel plants 10 KW. to 1250 KW.**

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1—Stirling, W.T. 200#, 500 H.P.
2—200 H.P. HRT suspended, Type-E, stokers, coal bunker, breeching and stack.
1—54" x 12' COCHRANE (live steam) separator.
2—793 H.P. B & W, 200#, single.
2—684 H.P. box header, 200#.
2—400 H.P. B & W, 200#, stokers, bunker, conveyor and piping.

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400 H.P. INGERSOLL-RAND FULL DIESEL ENGINE 6 cylinder, 4 cycle, 300 RPM. Including spare parts.

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70,000 Gal. Steel Storage Water Tank—
70' Legs
15 Ton McMyler Locomotive Crane—
125 KW—125/250 Volt—3 Wire D. C. Unit
25/50 HP Two Speed Motor 3/60/440
100 New Ceiling Fans 52"—D. C. 250 Volts
2400' Surface Condenser

ARTHUR S. PARTRIDGE
415 PINE ST. LOUIS

SLIP RING MOTORS, 3 PH., 60-CY.

HP	Volts	Make	Speed
700	2200	G.E.	900
400 (2)	400	Whse.	514
350	220–440	G.E.	1800
350	2200	G.E.	600
300	2300–4000	G.E.	1200
250	440–550	G.E.	600
200	2200–550	G.E.	1800
200	2200–400	G.E.	600
150	440–220	G.E.	1800
150	2200	G.E.	900
150	2200–440	Whse.	1800
150	550–2200	G.E.	1800
125	440–220	G.E.	600
100	550–2200	G.E.	720
100	440–220	G.E.	1800
100	220–440	G.E.	720
100	220–440	G.E.	900
75	220–440	G.E.	600

SYNCHRONOUS MOTORS, 3-PH., 60-CY.

600	2200	Whse.	900
400	440–220	Whse.	276
350	440–220	G.E.	900
240	2300–440–220	G.E.	600
200	2300–4000	G.E.	1200
150	2200	G.E.	1800
100	440–220	G.E.	1200

PUMP

1—8" Dredge Pump 1880 GPM, 120' Morris Machine Works with direct connected Slip Ring Motor 125 HP, 600 RPM, G.E.

AIR COMPRESSOR

1—465 CFM Ing. Rand Motor Driven Air Compressor Unit Type XRB 8" x 13" x 10" 300 RPM—100# Gu. No. 89242-3 driven by 75 HP GE AC Motor complete all Accessories including Receiver.

TRANSFORMERS—60 CYCLE

3—667 kva., G.E., 2300/4000-460/480 Volts.
3—667 kva., Whse. 22000-2300.
3—500 kva., Whse. 22000-2300.
3—350 kva., G.E., type H-KD 13200-2300.
3—333 kva., G.E., type H-KDD 2400-460/230.
3—250 kva., Whse. 13,800-460.
3—200 kva., G.E., type H 10000-600.
3—200 kva., G.E., H-KD 6600-2300/4000Y., 25 cy.
3—175 kva., G.E., 4000-480.
3—150 kva., G.E., type H-KDD 13200-2300.
3—150 kva., Al. Chal., type OISC 10400-2400.
1—100 kva., Pittsburgh, type OISC 2400-240-120.
3—100 kva., G.E., type H 2400-240/480.
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
3—100 kva., Whse. 22,000-2300.
2— 75 kva., G.E., type HK, 2300-230/115.
3— 50 kva., Moloney, 2300-230/115.
6— 50 kva., Whse. type SK, 13800-240/120.
3— 50 kva., Whse. 22,000-2300.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	1200
500	440/220	G.E.	IK	900
400	2200	Whse.	C.S.	1800
300	2200	G.E.	IE-K	1800
250	2200	G.E.	IK	600
200	220/440	G.E.	IK	720
150	2200	Allis. Ch.	AN	450
100	2200	G.E.	IK	600
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
100	220/440	G.E.	KT	720
75	2200	G.E.	KT	900
75	2300	G.E.	IE-K	1800
50	220/440	G.E.	K	1800

MOTOR GENERATOR SETS

75 KW, 125 V, 1200 RPM Westinghouse Conn. to 112 H.P. 2300/440 V, 3 ph, 60 cy. Ind. motor.
1—75 KW 125 V. 1200 RPM, GE Conn to 100 HP 440 V. 3 ph. 60 cy. Ind. motor.
1—75 KW, 250 V, 1800 RPM, Cr. Wh., Type CCD con. to 100 H.P., 2200 V., 3 ph., 60 cy.
1—250 KW Motor Generator Set, very modern, practically new, see further description under that heading.

A.C. GENERATORS

1—500 kva., 900 r.p.m., 2300 V. Whse. Condenser.
1—300 kva., 900 r.p.m., 240/480 V., G.E.
1—225 kva., 600 r.p.m., 2200-240 V., G.E.
1—187 kva., 900 r.p.m., 2200-550 V., Westghse.

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Motor Generator Sets—Synchronous Motors, etc.

MOTOR GENERATOR SETS & ROTARIES
3 phase, 60 cycle, A C.

1—G.E. 250 KW. 275 volt, 1200 RPM rotary

VERTICAL MOTORS

1—G. E. 50 HP 1200 RPM 3 ph 60 cy 220 V.
1—Reliance Fan-cooled 25 HP 1750 RPM 220/440 V.

SYNCHRONOUS MOTORS
3 phase, 60 cycle, A.C.

1—Burke 360 HP 900 RPM 440/220 Volt
1—Ideal 50 HP 600 RPM 2300 Volt

SLIP RING MOTORS, 3 phase, 60 cycle

Allis-Chalmers 250 HP 600 RPM 440 Volt
G. E. 60 HP 600 RPM 440 Volt
G. E. 62½ HP 1150 RPM 440/220 Volt

SQUIRREL CAGE MOTORS
3 phase, 60 cycle, 220/1440 Volts

1—150 HP 1750 RPM Allis-Chalmers
2—100 HP 550 RPM Westinghouse MS
1— 75 HP 575 RPM Westinghouse CS—368-A
1— 75 HP 600 RPM Fairbanks-Morse
1— 75 HP 720 RPM Lincoln I-P
1— 65 HP 860 RPM Allis-Chalmers
1— 50 HP 690 RPM Westinghouse CS—758
1— 50 HP 875 RPM Westinghouse CS
1— 50 HP 865 RPM Ideal
4— 20 HP 870 RPM West. T.E.F.C. CS—W-405
2— 20 HP 870 RPM West. CS—W-405
2— 15 HP 860 RPM Allis-Chalmers

ALTERNATOR SPECIAL, Allis-Chalmers, 125 KVA, 277 RPM, 3 phase, 60 cycle

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STEAM PUMPING ENGINES

1—Snow 6 mgd. C&FW Cr. Com. Opp. Type Cond. 20-40x14¾x36, with waterwork type cond.
1—Allis-Chal. 4 mgd. cr. com. cond. size 12x28x13x24, Fine cond.

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Birch Valves for reciprocating pumps.

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4—48" Chapman Motor operated solid wedge gate valves non-rising stem.
1—20" Rensselaer #13 Iron Body Bronze Mounted Hub End Gate Valve with 16" Iron Brass Lined Hydl. Cyl. with indicating Rod & Eyebolt, 100#
1—20" Crane 125# Flanged Hand Wheel operating Gate Valve.

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1—10 AD 4 pass 210 ft. Foster Wheeler over Cmb. Air Circulating and Tail Pump.

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2—New Kohler 1½ KVA, AC, 1500 watt, gas driven engine 120 volts, single phase, lighting generators.
1—New Kohler, 10KVA, 120 volts single phase, 60 cycle, gas engine driven generator sets.
2—New Lister-Blackstone "Nighthawk" Portable 5 KW 120 volts, AC, generator Sets, complete with four 1000 watt reflectors mtd. on 8' telescopic extensions mtd on two wheel spring mtd trailer.
1—New Kohler, 5 KVA, 120 Volts, gas engine driven Generator.
5—New Universal 5 KVA, 120 Volts, gas engine driven Generators.
1—Rebuilt 20 KW, 125 volts, Fairbanks-Morse Diesel Generator.
2—Rebuilt 15 KW, 110 volts, Allis-Chalmers gas eng. driven Gen.
1—Rebuilt 50 KVA Superior diesel eng. driven Gen., V-belt drive 220 volts, 3 phase, 60 cycle, AC Generator, .8 power factor, powered with Superior 100 H.P. 6 cylinder diesel engine.
1—Rebuilt 18.7 KVA Superior diesel engine driven Generator, direct connected, powered with 2 cyl. eng., 1200 r.p.m. and Columbia Generator, 240 volts, 3 phase, 60 cycle, .8 power factor. Machine in excellent condition.
1—Rebuilt Buda 15 KW gas engine driven Generator Set, 110 volts DC.
1—Rebuilt 7½ KW Winton gas eng. driven, 110 volt, DC Gen. Set.

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NEW and USED!

All makes & sizes for prompt shipment

2—500 H. P. Stirling 160#
1—312 H. P. Stirling 160#
3—300 H P. B. & W. 150#
1—200 H. P. Heine 160#
1—516 H. P. Stirling 200#

We want to buy 50 HRT boilers from 100 to 200 H. P. 125# pressure or better.

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120 KW ENGINE GENERATOR SET

1—120 KW G.E. Co. Type TRE Generator, 3/60/2300 volts, direct connected to 125# Harrisburg Fleming Steam Engine.

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1—50 HP Lidgerwood Double Drum Hoist, 24x24" drums, side by side, with or without AC or DC motor.

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2—600 GPM, 116 ft. head, Kingsford, size #4 Deep Well Pumps with 40 HP G. E. Co. Type CD-93, 230 V. DC vertical motors.

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2—Size 36" x 48" Link Belt Double Roll Coal Crushers, product size, 1½" to 3", spring relief type.

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MOTOR GENERATOR SETS
ROTARY CONVERTERS
SWITCHBOARDS BUILT TO ORDER

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2—150 HP W.E. Co. Type G, 80% P.F. for 3/60/220-440 volts, 1200 RPM, with direct connected exciters.
2—250 HP W. E. Co. Type HR, 100% P.F. for 3/60/2300 volts, Engine Type, one (1) at 240 RPM, one (1) at 277 RPM.

100 KW ROTARY CONVERTER

1—100 KW G.E. Co. Type TCC for 250 V—DC and 3/60/2300 V—AC, Transformer and Switchgear, 1200 RPM.

CENTRIFUGAL PUMPS

2—2700 GPM, 170 ft. head Lecourtnay Centrifugal Pumps driven by 150 HP W.E. Co. Type G, 80% P.F. Synch. motors 3/60/220-440 volts, 1200 RPM.

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1—15 ton Fairbanks Industrial Platform Scale, 5' x 8'.

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Built 1934 Used 3 Years
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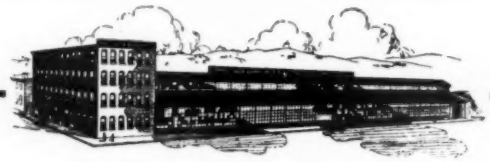

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1—5000 KW G. E. condensing.
1—3200 KW Allis-Chalmers condensing.
1—2500 KW G.E. condensing.
1— 500 KW West. condensing.
1— 300 KW G.E. non-condensing.

TRANSFORMERS
Single Phase, 60 Cycle
3—150 KVA Pittsburgh, 6600/220-440 V.
3—100 KVA G. E. 13,200-6600/2200 V.
2— 75 KVA West. 6600/230-460 V.
2—37½ KVA Pittsburgh 2200/220-440 V.

ELECTRIC MOTORS
3 Phase, 60 Cycle
1—165 HP G. E. Syn. 2200 volt, 900 RPM.
1—125 HP West. Syn. 2300 volt, 1200 RPM.
1—100 HP Crocker-Wheeler Syn. 220/440 volt, 1200 RPM.
1—100 HP West. Type CW Slip Ring, 2200 volt, 700 RPM.

If you have equipment, please send us a list

TIPPINS MACHINERY COMPANY
3528 Forbes St. Pittsburgh, Pa.

1—7500 KW. 5000 v. 60 Cy. 3 Ph. TURBO with Surface Condenser
1—4000 KW. TURBO 4150 v. 60 Cy. 3 Ph. with Cond.
1—3000 KW. TURBO 60 Cy. 3 Ph. 480 v. with Cond.
HEAT EXCHANGER 606 tubes 1¼" x 9'6"
1500 CFM 2 STAGE AIR COMP. 275 Hp. 2200 v. 60 Cy. 3 Ph. Syn. Motor Dr.
3—100 KW. 125-250 V. DC. G.E. TURBOS

1—New FAN 66750 CFM 2" to 6" Pres.
4—CENT. PUMPS 4166 GPM. 162' Head with 440 v. 60 Cy. 3 Ph. AC. Motors
1—36000 GPM, 27' head CENT. PUMPS
400, 700, 1500, and 2500 HP. A.C. Motors
TRAVELING CRANE 75 ton Case, 64' span, 3 motors. Also others.
750 KW. and 110 KW. AC HYDRO ELEC. PLANTS and others
3—559 Hp. 200# BOILERS with stokers

ROSS POWER EQUIPMENT CO., Indianapolis, Ind.

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90 HP Fairbanks Model 43B6, Diesel Engine
100 HP Fairbanks Style VA Diesel Engine
125 HP Venn Severin, Factory Rebuilt Diesel
150 HP Cooper Bessemer 2 cyl Horiz Diesel
250 HP Busch Sulzer 4B60 reconditioned
135 HP Bruce MacBeth Nat Gas Engine
160 HP Chgo Pneu Nat Gas Engine
60 HP Venn Severin 2300 volt Gen Set
360 HP Anderson KD 2400 volt Gen Set
2- 33 KW GE 2300 volt, 257 RPM Generators
1-150 KW GE 2300 volt 225 RPM Generator

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What have you for sale?

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TELEPHONE : 3-4818
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250 KW 125 V. 320 RPM with 4 cyl. 11 x 12 vertical uniflow steam engine, equal to new unit.
NEW 400 H.P. 4 cyl. 11 x 10 Vertical Uniflow steam engine bare unit. Supply any generator
50 KW GE 125/250 V. Marine Set.
200 K. W. 125 V. or 250 V. Skinner Uniflow engine.
750 K.W. 250 V. 720 R.P.M. interpole generator.
740 KW 250 V. induction bleeder turbo set, geared.
Boilers of all sizes, stokers, oil burners.
Turbine Sets, A.C. and D.C. to 1000 K.W.
Diesels of all sizes, large and small.

Send your lists of equipment

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6000	ITE	3 P	DC
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Amp.	Make	Type	Volts	
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2000	Condit	Y1	600	Manual
2000	G.E.	FK12	4500	M or S
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6	30	West.	SK-130	600/1200	1	11½	West.	SK	600/1200
1	30	West.	SK-130	600/1800	3	10	G. E.	RLC	400/1200
1	25	G. E.	RF-14	300/1200	1	7½	El. Dyn.		450/1350
1	20	G. E.	RLC	500/1500	2	7½	West.	SK-53	600/1800
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Also transformers, engines and cranes
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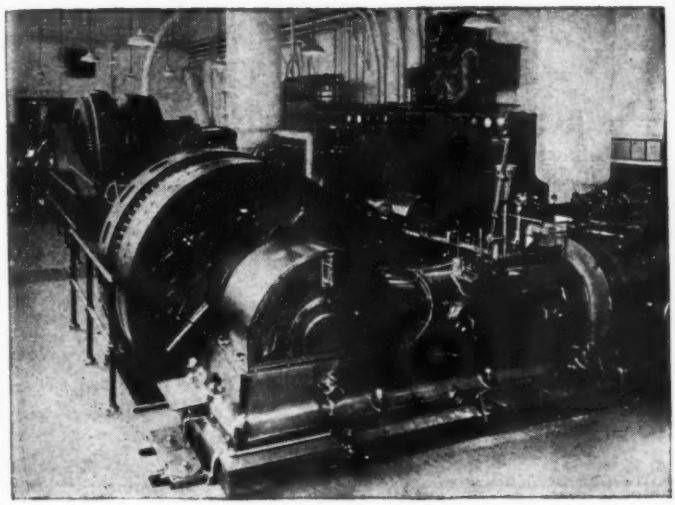

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Large selection—All sizes and types. Generator units, marine engines, gasoline engines, auxiliaries—also boilers, steam engines, turbo generators.

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Both have Exciters, and Switch Boards

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1—813 & 500 HP ASME 200# WT Boilers
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Complete pulverized coal equipment for two 500 HP boilers.
Riley 7 retort stoker for 600 HP boiler.
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800—500, 300 HP boilers, 200 pounds pressure
50 HP 150 pound pressure firebox code boiler
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300—55, 25 HP Diesel and gas engines
Safety Valves—Pumps all sizes

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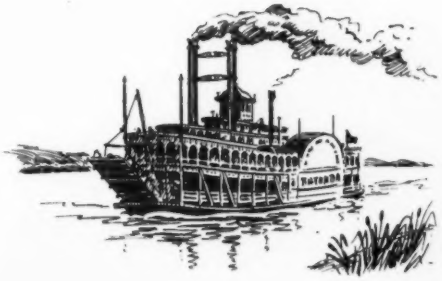
Or are you looking for—or offering—a business opportunity of special interest to men in the industry served by this publication?

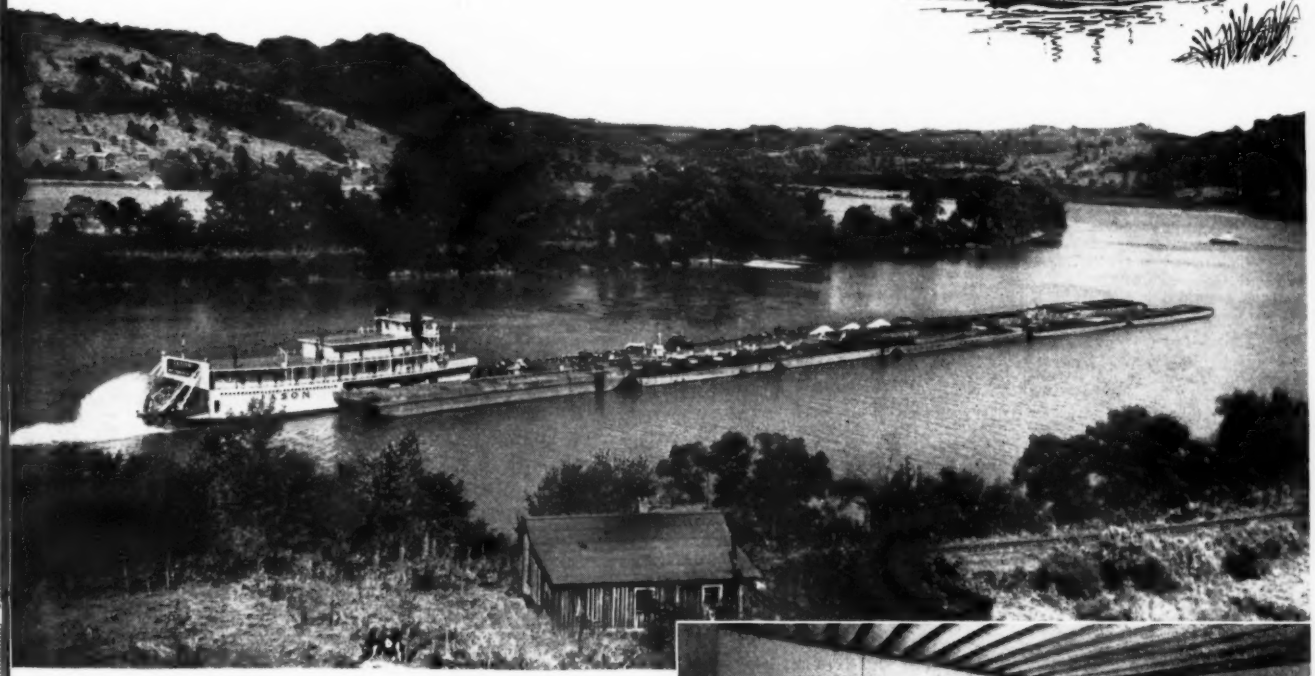
Or are you seeking buyers for surplus used equipment from your plant—or to buy such equipment from other plants?

The solution of any of these problems can logically be found *first* among *other* readers of POWER. You can get their attention—at small cost—through an advertisement here.

"Steamboat 'round the bend!"

THE "old Mississippi", as embroidered by Mark Twain's gifted pen, fairly swarmed with those "floating palaces" with their gilded gingerbread, tall belching stacks, throaty whistles, enormous cargoes, and—as Mark Twain would have it—still more enormous steam pressures. Far be it from us to explode those legends of handsome, gallant gamblers; beautiful, bedecked ladies; and tobacco-eating pilots . . . May they live forever in those immortal volumes.





RESPECT for engineering facts, however, compels us to say that one modern towboat like the JASON, pictured above, could push any of those fabled giants clear out of the river; and when it comes to steam pressure, the JASON'S 375 lbs. is many times higher than those fancied pressures carried by rival pilots with "a fireman sittin' on the safety valve".

The JASON, one of a fleet of modern towboats operated by the Union Barge Line Corp., was completed in 1940. Her two engines developing 2000 hp. are supplied by two oil-fired Foster Wheeler marine-type steam generators with a maximum output of 21,000 lbs. of steam per hour.

• We said the JASON was completed in 1940, but the fact is that she was not *fully* completed until the furnace linings were changed to Plibrico as shown opposite. In pushing heavy tows upstream, the boilers on towboats of this type are forced to the limit, imposing severe conditions upon the furnace linings. One trip was all it took to prove the superiority of Plibrico linings and Plibrico construction methods.

In your plant, as on the JASON, jointless Plibrico eliminates the vulnerable joints which are the real cause of furnace trouble. It simplifies installation by conforming to all special requirements — eliminates special tile shapes and delays in obtaining them.

You can obtain Plibrico immediately from 100 local stocks throughout the U. S. and Canada. Engineered and installed if desired; or your own maintenance men can install it if you prefer. Write for catalogs, prices, and address of nearest distributor; specify whether you wish book covering water tube or H.R.T. boilers.

PLIBRICO JOINTLESS FIREBRICK CO.
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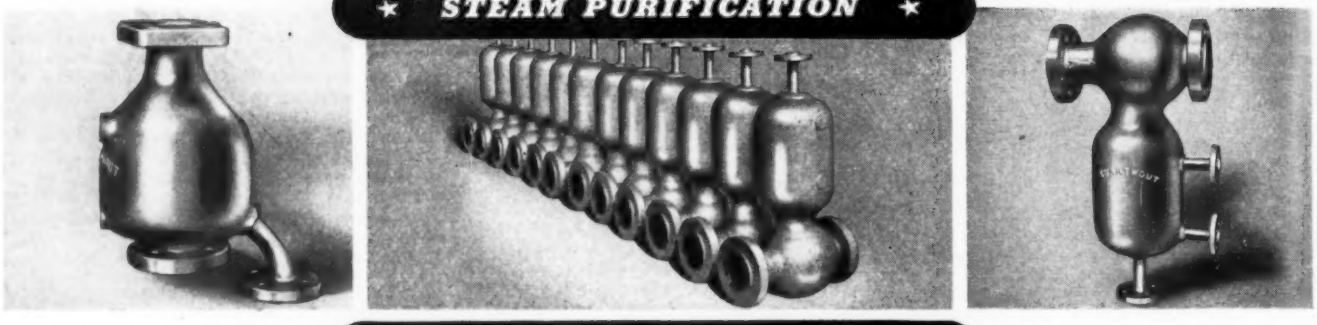

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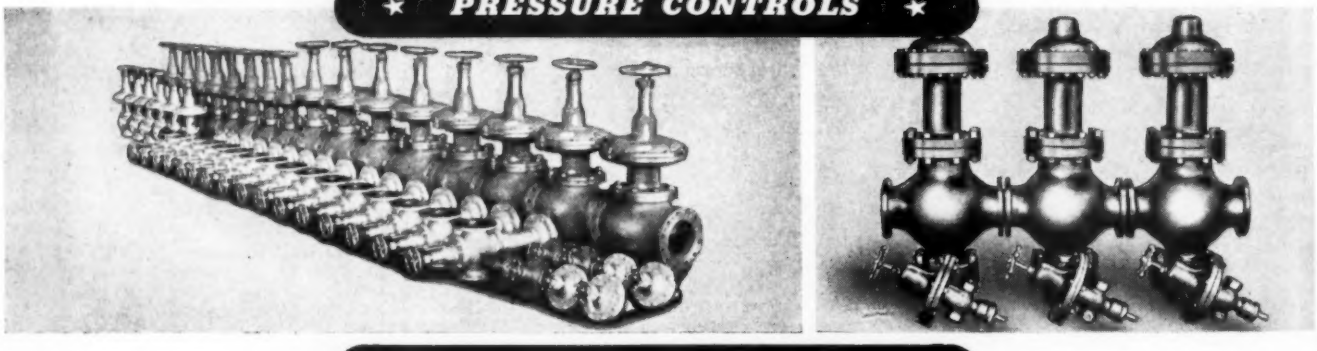

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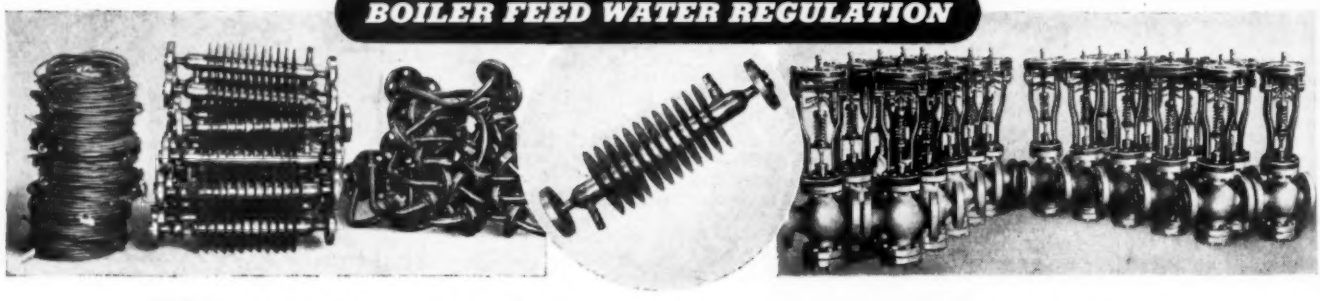

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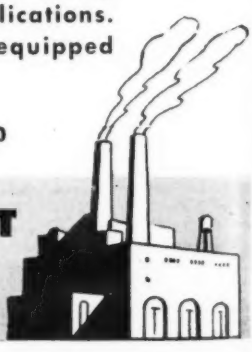

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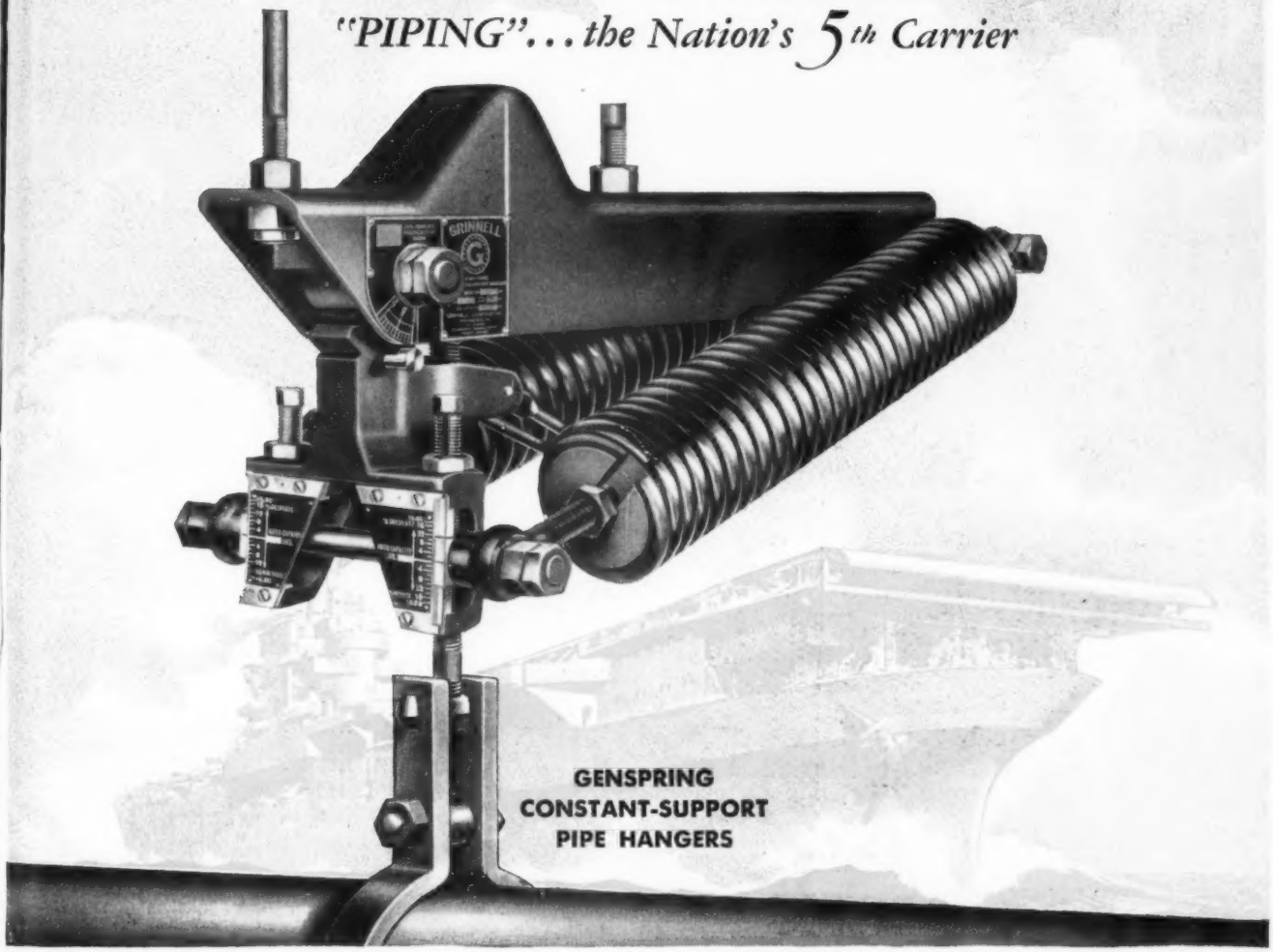

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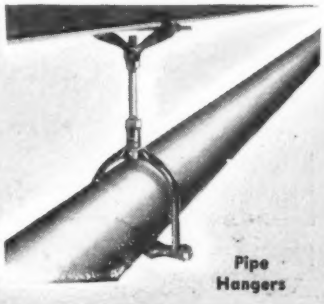
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IT IS a common thing for the poor people of Japan to sell their daughters . . . usually to satisfy the tax collectors for the Son of Heaven. What happens to these girls? Some of them go directly into the government owned houses of prostitution. But many of them are sold or leased to Japan's wealthy factory owners. They are regimented, trained, housed in huge jail-like dormitories . . . and made to operate modern machines for fourteen hours a day for such a pittance that years are required to earn their freedom.

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fact that Japan was able to flo
American stores with products "I
in Japan" despite *any* measures tai
to resist the invasion. You can wel
imagine what American workers will face if a victorious Nippon dictates conditions in the future. The choice will be between starvation or competition with Japanese slave labor at *their* level of living. Nothing else. Cutler-Hammer, Inc., 1358 St. Paul Avenue, Milwaukee, Wisconsin.

One of a series of advertisements dedicated to a fuller appreciation of the stake each American has in victory

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